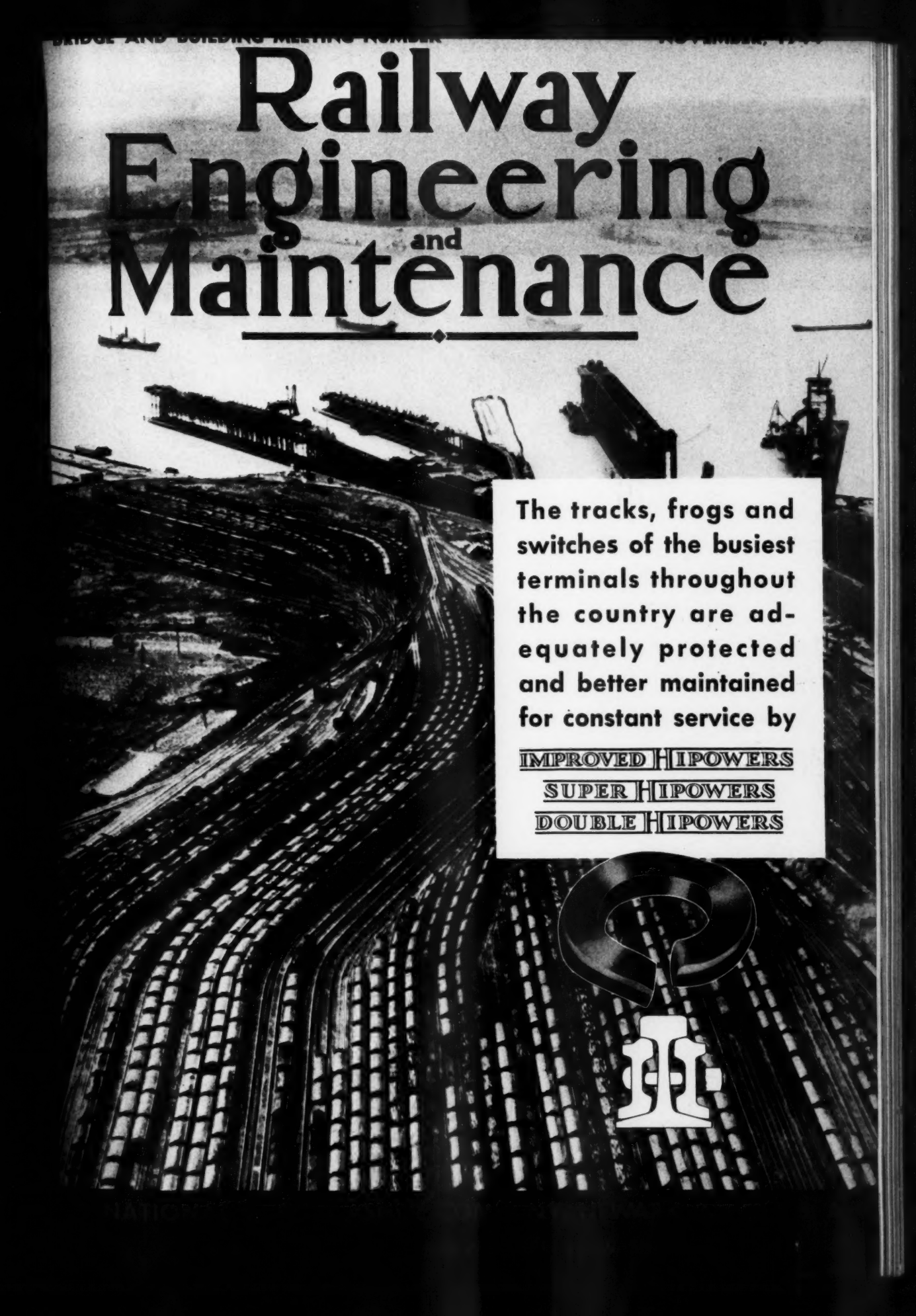
Railway Engineering and Maintenance

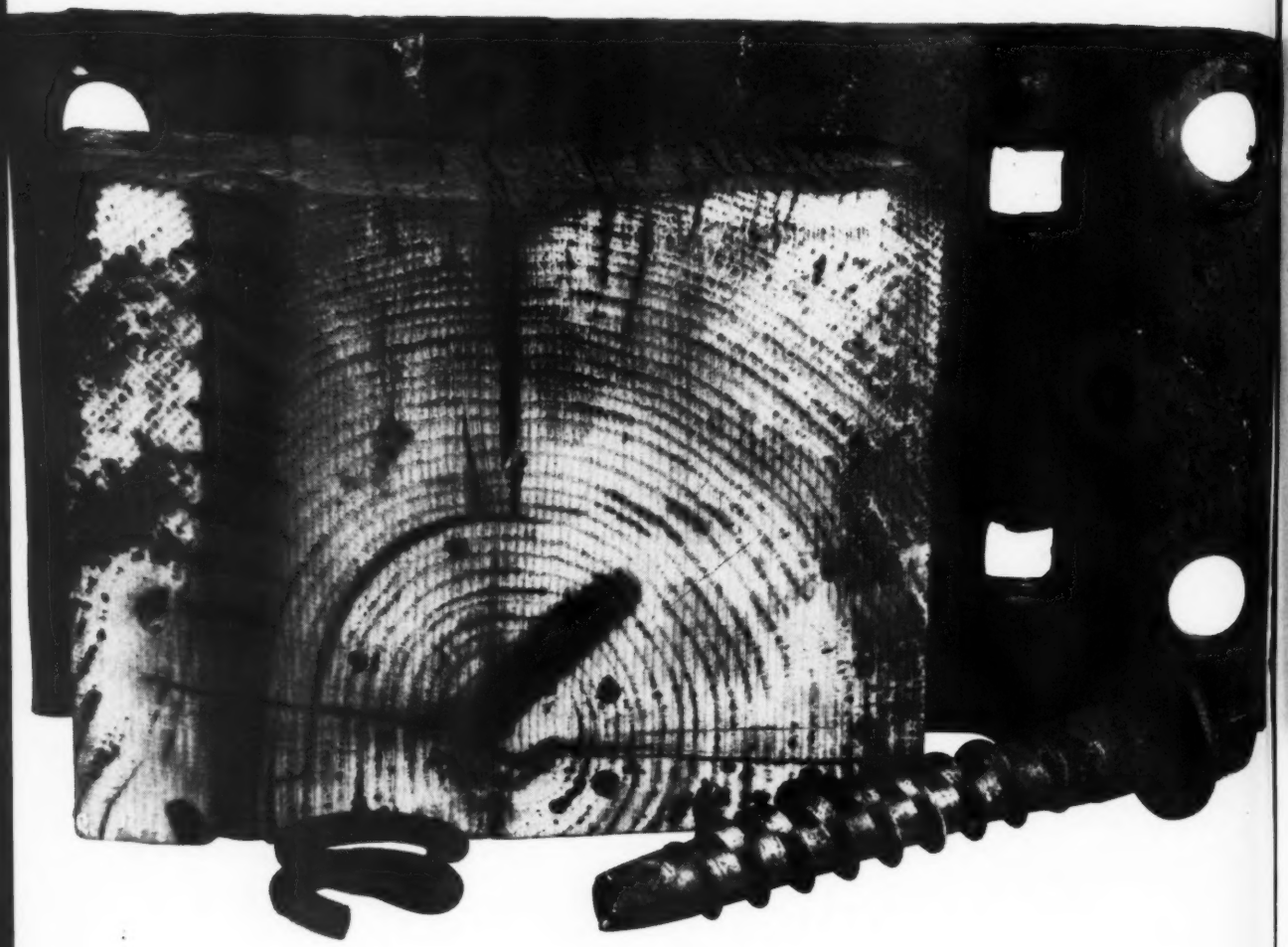


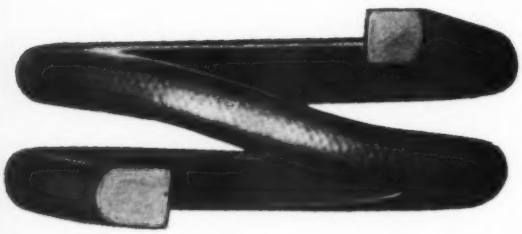
The tracks, frogs and switches of the busiest terminals throughout the country are adequately protected and better maintained for constant service by

IMPROVED HIPOWERS
SUPER HIPOWERS
DOUBLE HIPOWERS

Reliance HY-CROME Spring Washers

10 YEARS WITH THE RIGHT Spring Washer



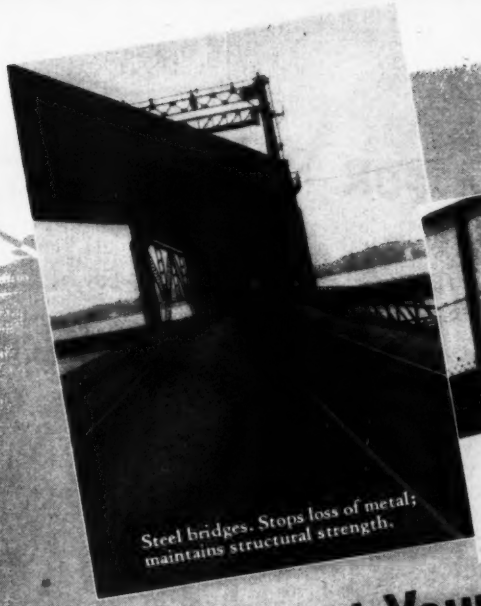


THACKERAY HY-CROME

● Ten years ago this tie plate construction was installed in track. The specimen section of a 7 x 9 x 8′ 6″ treated red oak tie illustrated above shows the excellent condition of the screw spike threads in the tie, and the very satisfactory spring recovery of the Thackeray Hy-Crome Spring Washer. The unusually small percentage of erosion in the top of the tie from tie plate vibration can be attributed to the efficient functioning of the Spring Washer over the ten-year period.

● Many other advantages are claimed for this type of construction where a Thackeray Hy-Crome Spring Washer can be used to advantage. Thackeray Hy-Crome Spring Washers are made to exacting specification requirements so that their efficient performance is assured. A Hy-Crome Spring Washer is available to meet every fastening problem. Write for Hy-Crome Track Folder.

EATON MANUFACTURING COMPANY
RELIANCE DIVISION MASSILLON, OHIO
Sales Offices: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal



How to Protect Your Bridges and Buildings Against Corrosion

The positive, lasting way to stop loss of metal on iron and steel bridges and buildings is to coat them with NO-OX-ID, the *original* rust-preventive.

It acts mechanically to exclude moisture and oxygen from the exposed surfaces and chemically to inhibit corrosion under the film.

How It Is Used

1. **Remove loose paint and rust scale.**
2. **Brush on a single coat of NO-OX-ID "A" Special over the remaining rust and old paint. NO-OX-ID will penetrate to the parent metal, stop further corrosion, and loosen the old rust scale.**
3. **As scale falls off, touch up spots with NO-OX-ID.**
4. **One to three years later apply a finishing coat of NO-OX-ID filler to give lasting protection. Paint may be applied over coating if desired.**

Use NO-OX-ID **for bridges, turntables, conduit pipes, tanks, signal towers. Protect and lubricate bridge expansion bearings with NO-OX-ID. Chemical inhibitors join with a lubricating base to form a coating which never hardens and which maintains contact with metal during and after movement. Under present conditions, with fewer men to do the work, the protection afforded by one application of NO-OX-ID, plus the speed with which the work is done, is important.** ***Use NO-OX-ID*** **for lasting rust prevention and reduction of maintenance costs.**

The ORIGINAL RUST PREVENTIVE

DEARBORN CHEMICAL COMPANY
Dept. U, 310 S. Michigan Ave., Chicago
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MEMBER BRIDGE AND BUILDING SUPPLY MEN'S ASSOCIATION

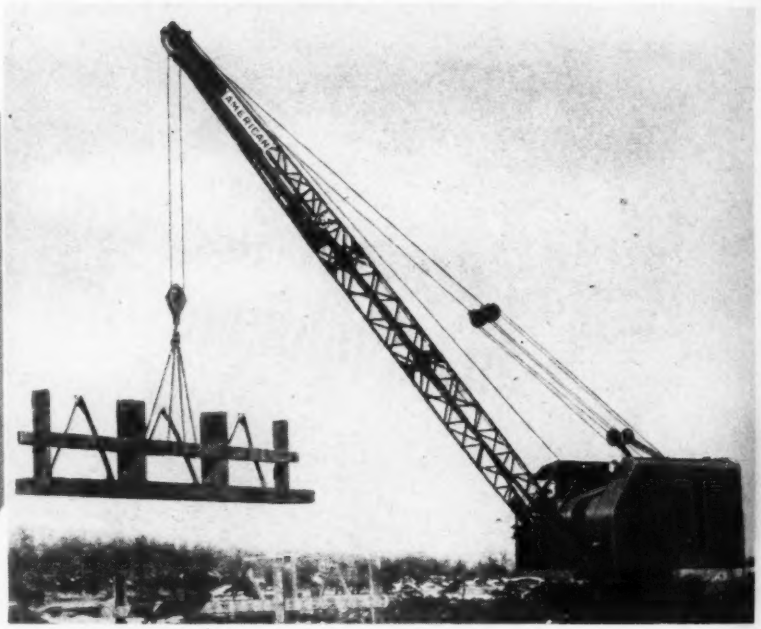
Published monthly by Simmons Boardman Publishing Corporation, 105 W. Adams St., Chicago 3, Ill. Subscription price: United States and Possessions, and Canada, $2.00; Foreign, $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the postoffice at Chicago, Ill., under the act of March 3, 1879, with additional entry at Mount Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago 3, Ill.

American MATERIALS HANDLING FOR RAILROADS

FOR

YARDS AND STORES
•
MAINTENANCE OF WAY
•
WOOD PRESERVING PLANTS
•
CONSTRUCTION WORK

THE American LOCOMOTIVE CRANE



The AMERICAN Locomotive Crane was designed for just this variety of materials handling work. Scattered over the country with the nations leading railroads, their mobility, ease of operation, simplicity of control, have demonstrated that they are an efficient materials handling method for bucket, magnet, and hook work. They make the use of old machines and other methods costly and wasteful by comparison.

Under your jurisdiction is materials handling that can be done better with an AMERICAN Locomotive Crane. Now is the time to look into it.

Plan now . . . but wait for **AMERICAN!** 4447

AMERICAN MATERIALS HANDLING *for* EVERY INDUSTRY

AMERICAN HOIST & DERRICK CO.
Saint Paul 1, Minnesota
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Wherever wire rope is fastened . . . . use genuine **CROSBY CLIPS** *with the Red-U-Bolt*

the daddy of them all

CUT DEVIL

WARREN TOOL CORPORATION

WARREN, OHIO

It was back in 1922 when Warren Tool Corporation engineered and produced the first slim pattern track chisels. Incorporated with this new and advanced tool design was the use of electric furnace alloy tool steel. Railroads, quickly recognizing the efficiency of the slim pattern, used them in large quantities . . . in fact, it quickly became the standard pattern for all railroad track chisels. The new chisel was given the name CUT DEVIL.

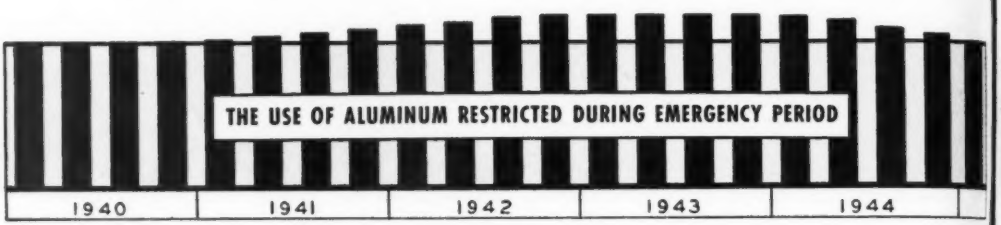
We have continued the policy of improving tool efficiency on the track. For example, the most recent demonstration of this fact is the easy, safe, and time-saving Flex-Toe claw bar, an exclusive product of Warren Tool Corporation.

★ ★ ★

Fairmont

AGAIN LEAD IN WEIGHT REDUCTION AS THEY

Historical Report of Fairmont Inspection Car Weights from 1940 Through the Emergency Period. Note Immediate Reduction of Weight with Aluminum Again Available.



The chart gives the weight history of Fairmont Inspection Cars for five years. Early in 1941 restrictions were placed on the use of aluminum and the chart shows a gradual rise as weights increased due to heavier, substitute materials. Note the rapid drop as weights were immediately reduced when aluminum again became available.

Fairmont interchangeability permits the use of Aluminum Parts to reduce the weight of the heavier models delivered during the Emergency Period. Details regarding such a change-over will be furnished on request.

Early in 1941 when the use of aluminum was restricted, Fairmont asked the railroads to choose between two types of emergency period designs—special duration models which would be only a little heavier than the aluminum models, but special throughout—or our standard designs using interchangeable steel parts for those previously made of aluminum. These models would be heavier but would create no new service and parts problems and would permit easy reconversion to aluminum parts as soon as aluminum was available. Your decision to retain our standard designs, even though heavier, during the Emergency Period is now having its reward. For all Fairmont inspection cars which were built with the maximum amount of substitute material can be modernized now with interchangeable aluminum parts that will reduce the weight from 80 to 100 pounds.

Making major parts of standard dimensions so that equipment can be modernized at moderate cost has been an ideal of Fairmont service for more than thirty-five years. It is an important reason why railroad men who want to keep obsolescence at a minimum repeatedly choose Fairmonts—why there are more Fairmont Motor Cars in service than all other makes combined.

Now that Fairmont Inspection Cars can again be made with aluminum parts, they are more than ever the first choice of those who want the safety of light weight as well as the utmost in power and durability.

OF ALL THE CARS IN SERVICE TODAY MORE THAN HALF ARE FAIRMONTS

LIGHT-WEIGHT ALUMINUM INSPECTION CARS

HAVE ALWAYS LED IN STRENGTH AND POWER

ALUMINUM WEIGHS ⅓ AS MUCH AS STEEL and Fairmont engineers are again using the weight-saving advantages offered by Light-weight Aluminum to reduce the lifting weight of Fairmont Inspection Cars.

Once again, most of the frame members and nearly all of the other parts of Fairmont Inspection Cars are made of LIGHT-WEIGHT ALUMINUM. The rear lift of the Fairmont M9 and M19 inspection cars (using the extension lift handles) is thus reduced to only 98 pounds. This, of course, makes the cars easily handled by one man—a *safety* feature that is especially appreciated by the men who frequently travel alone on regular inspection or emergency repair trips.

Fairmont's modern design and strong construction gives you the rugged strength you need with light weight.

Fairmont Railway Motors, Inc.
Fairmont, Minn.

Wood that's Pressure-Treated with . .

WOLMAN SALTS* Preservative

Wolmanized Lumber*—wood impregnated with Wolman Salts—is highly resistant to decay and termite attack. Vacuum-pressure treatment drives the preservative deep into the wood; fibre-fixation prevents its washing out or leaching.

Wolmanized Lumber is clean, odorless and paintable. It does not increase the fire hazard. It gives you all of the usual advantages of building with wood—light weight, ease of handling and erection, strength and resilience.

MINALITH* Fire Retardant

Wood that has been pressure-treated with Minalith fire retardant will not support combustion. Because it will not catch or spread fire, it helps confine fire to points of origin. It maintains its load-bearing strength without sudden collapse.

Minalith fire retardant has no disagreeable odor or harmful effect on workmen's skin or clothing. When properly dried, it can be painted. Lumber so treated is extremely valuable wherever fire is an ever-present hazard.

WOLMANIZED LUMBER has been used for many years by the railroads—in bridges and trestles, shops and engine houses, coaling stations and water tanks, warehouses and freight stations, passenger stations and a score more types of railway structures. Service records covering many millions of feet of this lumber prove its worth. The same high quality of pressure treatment that made these records possible is now available to you in Minalith-treated lumber. American Lumber and Treating Co., 1659 McCormick Bldg., Chicago 4, Ill.

MEMBER BRIDGE AND BUILDING SUPPLY MEN'S ASSOCIATION

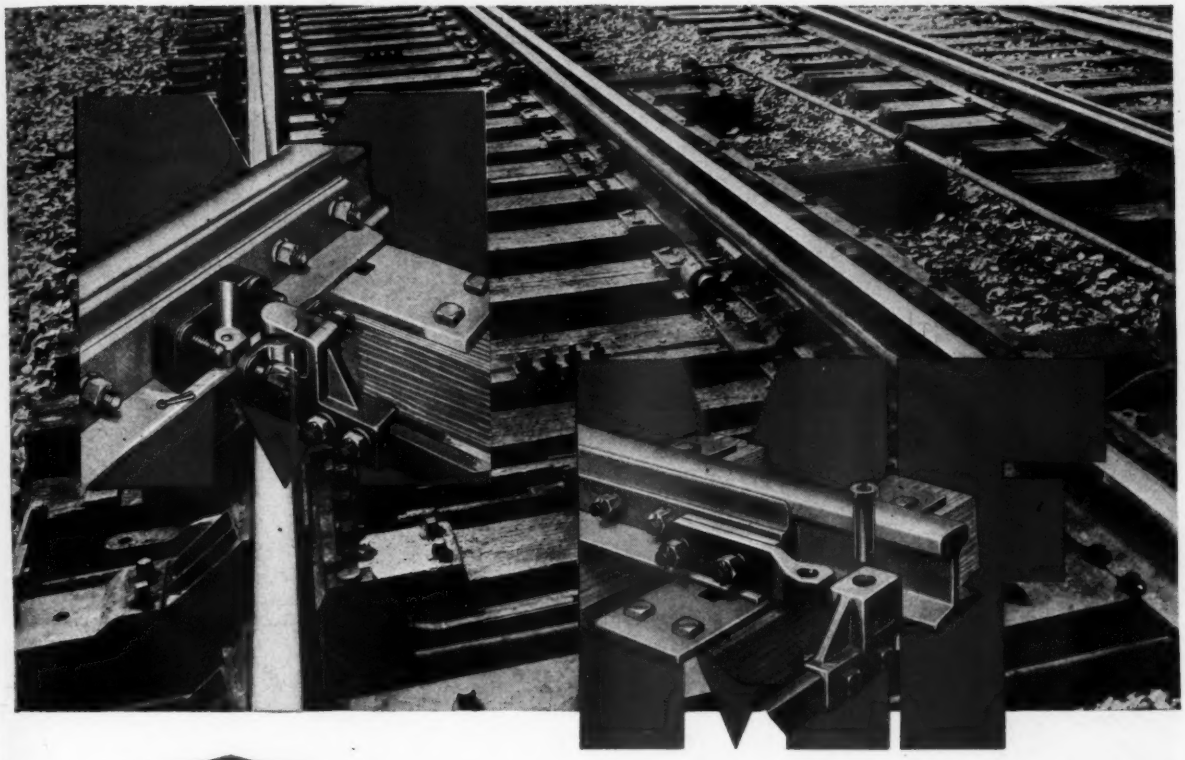
*Registered Trade Marks

WOOD THAT'S *Alloyed* FOR SAFETY AND ENDURANCE

AMERICAN LUMBER & TREATING COMPANY

Specify RACOR Types M and MF Switch Clips

and get LONG LIFE and LOW MAINTENANCE



RACOR Types M and MF Switch Clips eliminate those two bugaboos of railroad operation: constant replacement and heavy maintenance costs. Types M and MF Switch Clips cut down switch maintenance because of their built-in ruggedness, facility of inspection and easy access when lubricating.

Especially valuable on rails six inches and higher, they prevent rolling of switch points. Switches equipped with these clips will pass the most rigid interlocking tests.

Applicable to any type of switch or switch rod, they are highly recommended for power-operated switches. Machined to very close tolerances, and subjected to rigid quality control, you can expect and get exceptionally long service. May we suggest you call our representative who will be glad to give you helpful information and tell you about Racor Types M and MF Switch Clips.

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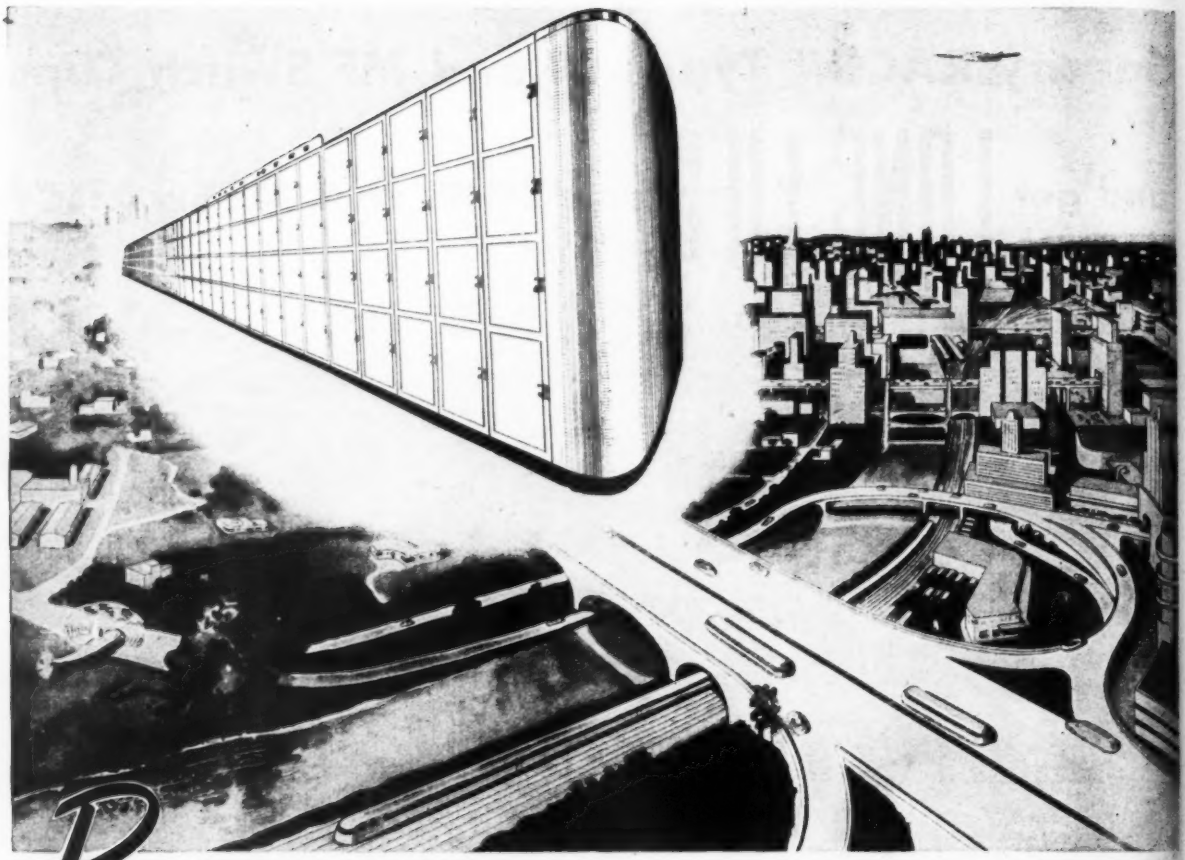

POST WAR PEOPLE WILL ALL BE TRAVEL-WISE (LOCKER-WISE)

YOU KNOW—and we know—how the enormous volume of passenger traffic during the past few years has stepped up the demand for the newer things in transportation service. Whether or not the volume of travel falls off after the war this new generation of travelers will expect and demand an extension of the convenience, comfort, safety, speed and service which they have discovered can be theirs when they travel by rail, bus or air.

American Parcel Lockers and American Locker Service have been put to the test during these war years. That over 60% of today's parcel checking in rail and bus stations and terminals is in self-service lockers is evidence that the public knows a good thing when it sees it,—and uses it. Our consultants will gladly confer with you without obligation regarding the inclusion of parcel lockers in your plans for renovation or new building.

AMERICAN LOCKER COMPANY, Inc.

Executive Offices

211 CONGRESS ST., BOSTON 10, MASS.

DISTRICT OFFICES

BOSTON NEW YORK PHILADELPHIA PITTSBURGH ATLANTA CLEVELAND CHICAGO DALLAS LOS ANGELES

CONVENIENCE - SAFETY - NO WAITING IN LINE - THE KEY IS YOUR CHECK

BARCO TYTAMPERS

for Spot tamping
Gang tamping
Cribbing

For years, Barco Tytampers have been faithfully "workin' on the railroad"...saving time, saving money, saving manpower. They are efficient, dependable, adaptable to all conditions. Write for complete information.

BARCO

MANUFACTURING COMPANY, NOT INC.

The Free Enterprise System Is The Salvation of American Business

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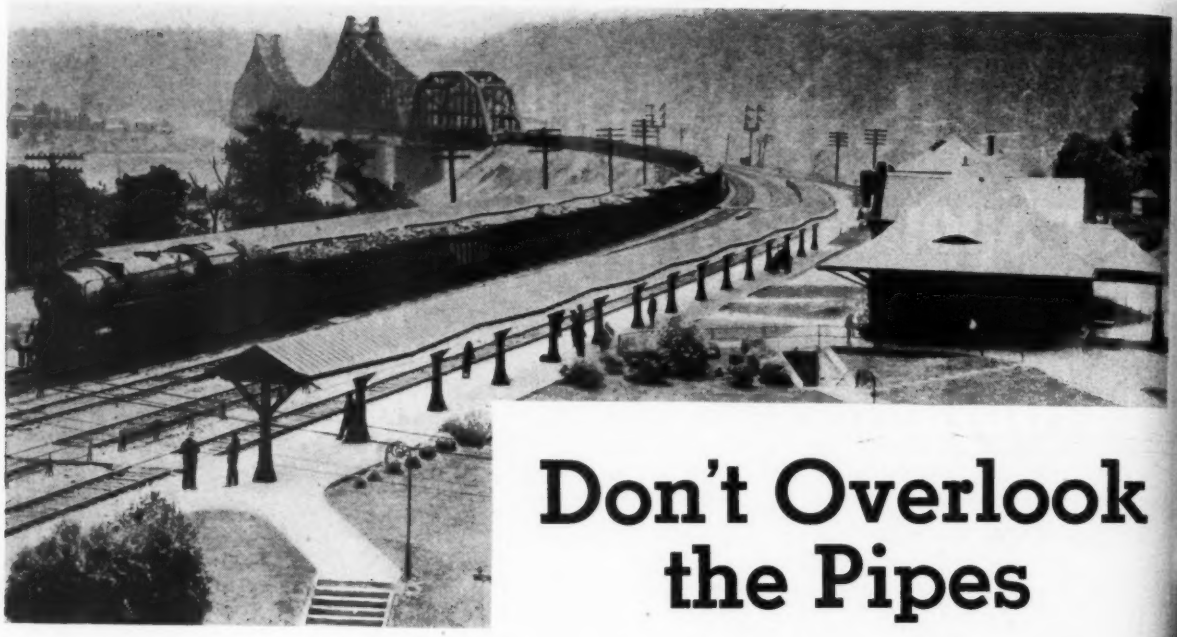


Don't Overlook the Pipes

Pittsburgh's Experts can clean your pipes better, faster and more economically.

To be of full assistance in helping the railroads offer their customers the best in service now and postwar, *pipes must be clean!*

Water mains, gas mains, downspouts, drainage pipes, sewer mains, urinal pipes, or, in other words, all of the possible kinds of pipes that are used in railroad buildings, stations, yards and terminals can be thoroughly cleaned by Pittsburgh's engineers.

The sand, slag, dirt and sticks pictured above were removed from 710' of 24" sewer with our special tools.

PITTSBURGH PIPE CLEANER COMPANY

433 Melwood Street, Pittsburgh 13, Penna.

PHILADELPHIA - NEW YORK - BALTIMORE - WASHINGTON - CHICAGO - ST. LOUIS - DETRO

High-Speed Schedules

Need WEED-FREE

In conformity with their extensive modernization program to insure customers the best of service, the Missouri-Kansas-Texas lines utilize Woolery Weed Burners to keep tracks and roadbed free and clear of destructive vegetation.

Under the increased speeds and heavier loads of present railroad operation, a stronger, weed-free roadbed and track structure is absolutely essential.

Woolery Weed Burners can be of great assistance to your railroad too, in helping to maintain high-speed schedules. To meet all vegetation conditions, Woolery Weed Burners are available in various size models.

M·K·T Katy Lines

WOOLERY Labor-Saving EQUIPMENT

Weed Burners 5-burner, 3-burner, 2-burner and 1-burner models available

Tie Cutters

Creosote Sprayers

Giant Octopus Model with 5 burners for main track

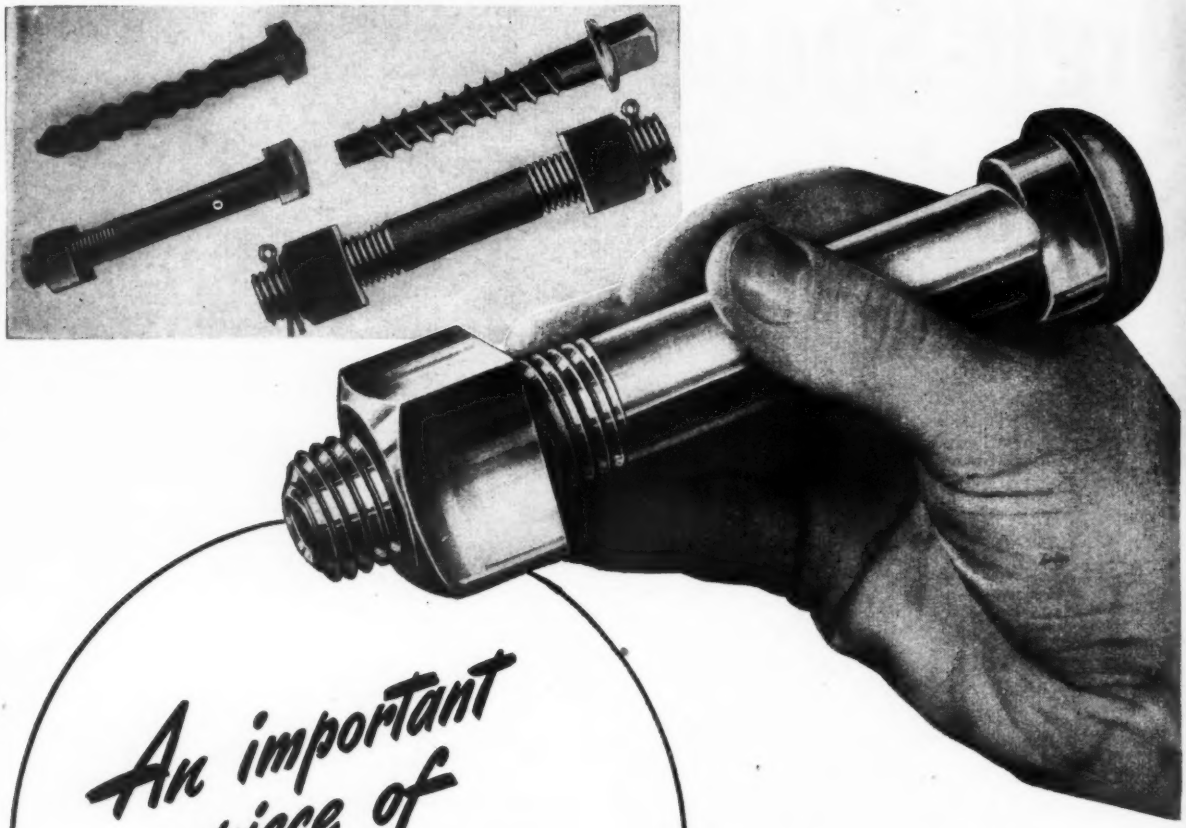
WOOLERY MACHINE COMPANY

MINNEAPOLIS — Pioneer Manufacturers of — MINNESOTA

RAILWAY MAINTENANCE EQUIPMENT

RAILWAY WEED BURNERS • MOTOR CARS • TIE CUTTERS • TIE SCORING MACHINES • RAIL JOINT OILERS • CREOSOTE SPRAYERS • BOLT TIGHTENERS

EXCLUSIVE EXPORT REPRESENTATIVES: PRESSED STEEL CAR COMPANY, INC., PITTSBURGH, PENNA.



An important piece of RAILROAD EQUIPMENT

It is not measured in feet, nor weighed in tons — yet the Track Bolt is an important piece of your Railroad equipment. If made right—as Oliver makes them—track bolts fit into place smoothly, nuts thread on readily and hold tight. Oliver products meet railroad requirements admirably because we have been making bolts, nuts, rivets and threaded products for the railroads since 1863.

Today they are modern in every respect, meeting yor strictest specifications.

Makers of a complete line of BOLTS, NUTS, GAGE RODS and RIVETS, as well as SPECIAL FASTENERS for railroad service.

OLIVER
IRON AND STEEL
Corporation

SOUTH TENTH AND MURIEL STREETS
PITTSBURGH, PENNSYLVANIA

Write for Oliver Railroad Catalog. Covers the complete line.

HOW YOU CAN USE OFF-TRACK *TOURNAPULLS*

ON MAJOR RAILROAD MAINTENANCE PROJECTS . . .

Seven Tournapulls were used on this major maintenance project on the C. B. & Q. lines . . . difficult ground conditions won't stop these versatile, rubber-tired rigs

Rubber-tired earthmovers help protect and widen banks and slopes on east-bound main line of C. B. & Q. without interrupting traffic . . . make 50 to 60 minutes of every work hour productive

FOR FAST, low-cost handling of the C. B. & Q.'s major maintenance project on a nine-mile stretch between Chariton and Lucas, Iowa, Marsch-Peterson Co., of Chicago, Illinois and Omaha, Nebraska, used seven off-track, rubber-tired Tournapulls. These versatile units not only handled the earth-moving necessary to protect and widen banks and slopes, but also dug and cleaned out drainage ditches along the right-of-way.

Tournapulls Operate Under Difficult Conditions

Operating under difficult ground conditions in saturated gumbo with heavy blue clay underneath, the Marsch-Peterson Tournapulls moved over 900,000 yards of dirt . . . hauled it about one-half mile along the roadbed, crossed the main line track, and wasted the material over an embankment on the other side . . . all without any interruption to vital wartime transportation.

As this C. B. & Q. project demonstrates, you can save on equipment investment and manpower with Tournapulls. One-man operated, they load, haul and spread in one continuous cycle. You need no costly, one-purpose loading units . . . no extra spur tracks on continual switching . . . no big crews. 50 to 60 minutes of every working hour is spent actually working.

What's more, the same prime mover is quickly and easily inter-changed for lifting and carrying with large-capacity Tournacranes, and for hauling with Tournatrailer.

Many Uses for Interchangeable Rigs

Here are just a few uses for your Tournapulls, Tournacranes and Tournatrailers:

New grade construction
Curve relocation and grade reduction
Widen banks and slopes
Dig, widen and deepen drainage ditches
Grade for new sidings, spur and passing tracks
Remove slides, fill-in and repair washouts
Coal handling and stockpiling
Moving and shifting tracks
Transporting and placing bridge members, drainage structures, etc.
Clearing tracks of wreckage in emergencies
Loading and unloading work train supplies and freight cars
Lifting, moving and stacking ties, timbers and rails in supply yards.

FREE

Magazine Features Railroad Jobs

How other alert railroads cut costs with LeTourneau equipment is told and pictured in the November issue of the LeTourneau CO-OPERATOR magazine. Fill in the coupon below and mail it TODAY for your FREE copy of this 16-page, illustrated magazine.

R. G. Letourneau, Inc., Dept. REM-11/44, Peoria, Ill. Please send me the November issue of the CO-OPERATOR, which features railroad jobs—also place my name on your mailing list to receive this 16-page earthmovers magazine ten times yearly.

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TITLE_____

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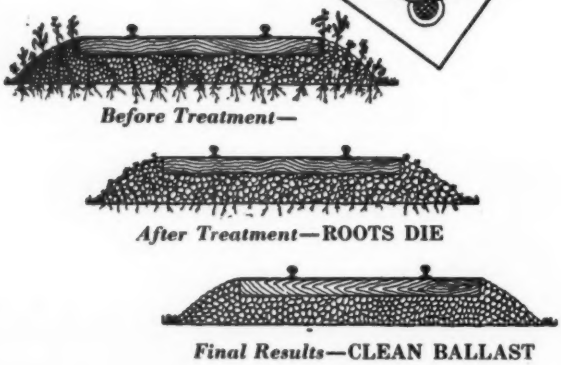


Before Treatment—

After Treatment—ROOTS DIE

Final Results—CLEAN BALLAST

WEED-FREE TRACK is essential to every railroad. Here's why:

- Prevents fouling of ballast.
- Improves drainage.
- Retards decay of ties.
- Eliminates locomotive slipping.
- Reduces fire hazard.
- Simplifies track inspection and tie replacement.
- Improves appearance.

Applications of ATLACIDE and ATLAS "A" progressively reduce weed growth until clean track is obtained. At the same time the "annual premium" for protection against weeds is correspondingly reduced. The point is soon reached where all future treatments are confined to checking new growth at a minimum cost.

Atlacide and Atlas "A" then "pay dividends" in lower maintenance cost and better maintained track.

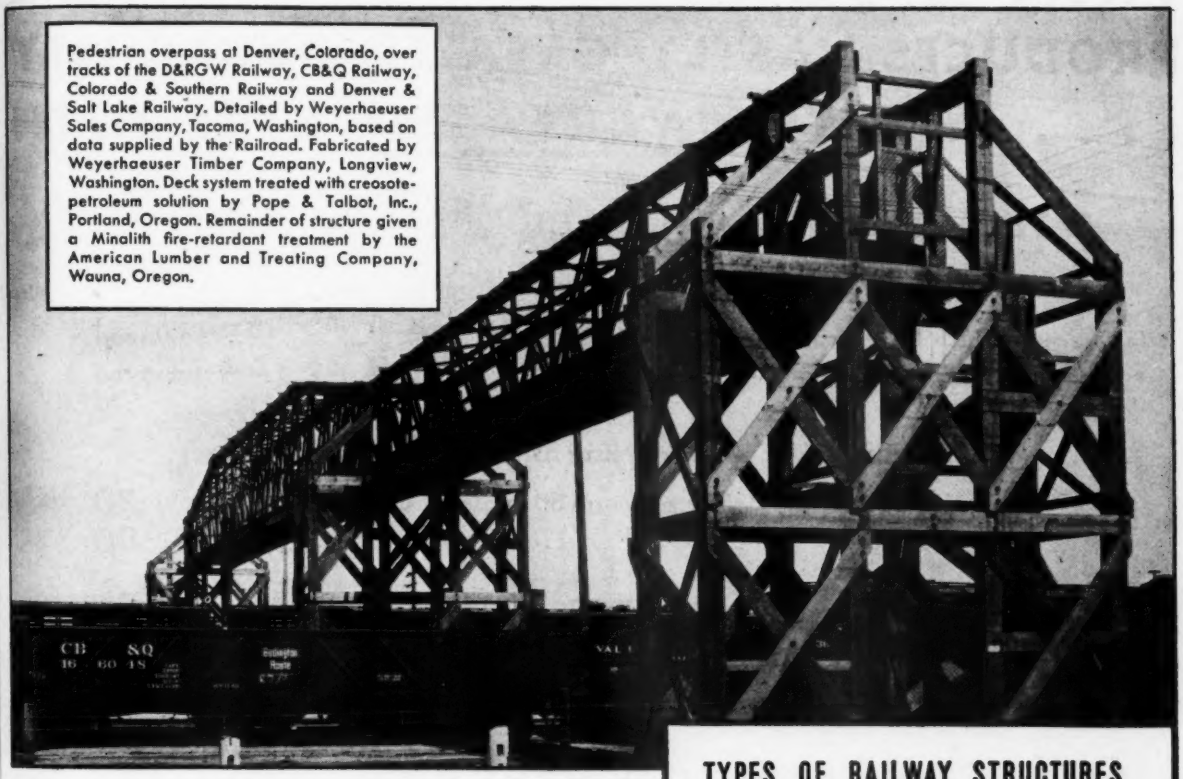
Now is the time to make plans for weed control next season. We invite your inquiry for thorough discussion of your particular weed problems and offer our service in their solution.

Over Twenty-five Years of Weed Control Service

CHIPMAN CHEMICAL COMPANY, Inc.

Chicago, Ill. · BOUND BROOK, NEW JERSEY · Portland, Ore.
Houston, Texas · Palo Alto, Calif. · No. Kansas City, Mo. · Winnipeg, Man.

70 RAILROADS USE TECO CONNECTORS FOR TIMBER STRUCTURES



Pedestrian overpass at Denver, Colorado, over tracks of the D&RGW Railway, CB&Q Railway, Colorado & Southern Railway and Denver & Salt Lake Railway. Detailed by Weyerhaeuser Sales Company, Tacoma, Washington, based on data supplied by the Railroad. Fabricated by Weyerhaeuser Timber Company, Longview, Washington. Deck system treated with creosote-petroleum solution by Pope & Talbot, Inc., Portland, Oregon. Remainder of structure given a Minalith fire-retardant treatment by the American Lumber and Treating Company, Wauna, Oregon.

American and Canadian railroads—more than 70 of them—use the Teco connector system of construction for their heavy duty timber structures. The pedestrian overpass illustrated above, contains one 170 ft. span and one 90 ft. span.

Railroad engineers and architects are using the Teco system of construction for a wide range of structures such as listed at right.

A nation-wide list of Teco fabricators is at your service—names on request. Write for free bulletins.

TYPES OF RAILWAY STRUCTURES USING TECO TIMBER CONNECTORS

1. Roof Trusses
2. Overhead Cranes
3. Timber Bents
4. Connections between pile heads and caps
5. Trestles
6. Ballast deck stub piles
7. Piers
8. Pier Fenders
9. Sway Bracing
10. Coal Pockets
11. Auto Loading Dock
12. Between Rail Post and Tie Connections
13. Bridge Decks
14. Scaffolding
15. Cooling Towers
16. Warehouses

TIMBER ENGINEERING COMPANY, INC., of WASHINGTON, D. C.

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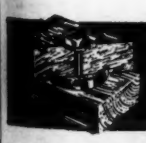
MEMBER BRIDGE AND BUILDING SUPPLY MEN'S ASSOCIATION



SPECIFY TECO CONNECTORS AND TOOLS

Endorsed by Leading Lumber Manufacturers & Fabricators

HIGHEST TESTING

EXHAUSTIVE EXPOSURE TESTS SHOW THAT POZZOLITH CONCRETE PRODUCES VASTLY GREATER DURABILITY . . . . . WITH *INCREASED* STRENGTH

1. Pozzolith increased DURABILITY—

In SEA WATER—after 142 Cycles of Freezing and Thawing

Plain Concrete—of 39 beams tested.....15 survived
Pozzolith " —" 77 " " .....76 survived

In FRESH WATER—Freezing and Thawing

Plain Concrete—after average 50 cycles..durability factor = 20
Pozzolith " — " " 176 " " " = 80

2. Pozzolith increased STRENGTH—

3-day Compressive.....50 to 70%
28-day " .....12 to 25%

3. Pozzolith cut WATER-CEMENT Ratio.....13 to 15%

4. Pozzolith cut BLEEDING.....55 to 60%

With the exception of durability, **the many important advantages of Pozzolith** (Cement Dispersion) **can be measured during the construction of a job.** Because of this fact the following benefits have been irrefutably proved during the 11 years' use of Pozzolith in millions of yards of concrete:

1. Adds greater workability
2. Cuts bleeding and segregation
3. Gives speed in placing, stripping, finishing
4. Cuts water-cement ratio
5. Produces greater strength
6. Lowers initial costs.

Now the amazingly high durability of Pozzolith Concrete has been indisputably proved **by the findings of the Nation's highest testing authority.**

Here's some post war preparing that you will want to do **now.** Write and we shall be glad to submit data which you can use to improve concrete and lower costs.

THE MASTER BUILDERS COMPANY

CLEVELAND, OHIO TORONTO, ONTARIO

MASTER BUILDERS PRODUCTS

MASTER B

AUTHORITY

Findings prove

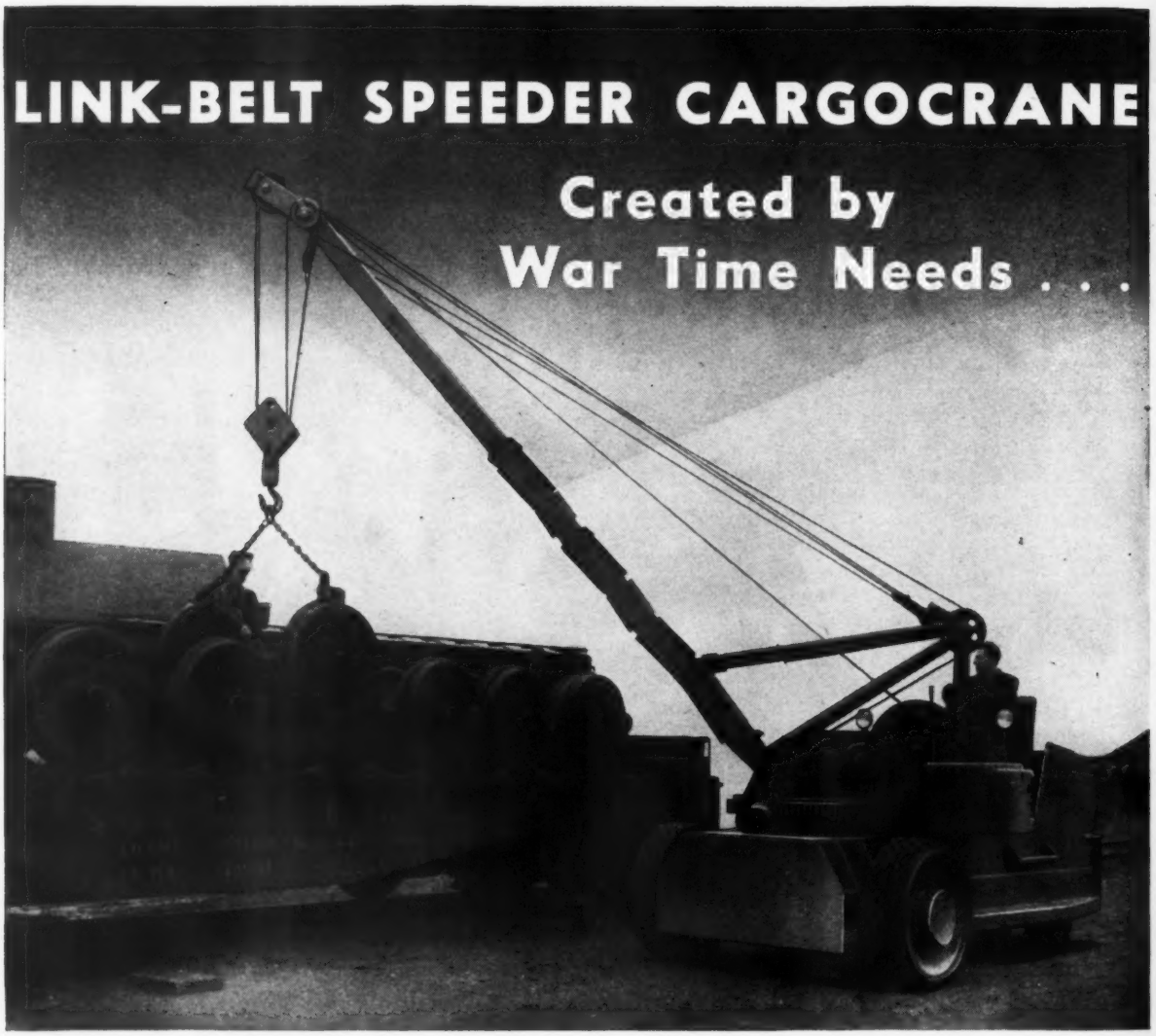
PRODUCES DURABLE CONCRETE LIKE THIS...

One of the many Erie Railroad bridges in which Pozzolith was used to produce more durable, lower-cost concrete.

BUILDERS

MASTER BUILDERS PRODUCTS

LINK-BELT SPEEDER CARGOCRANE



TAILOR-MADE FOR POST WAR RAILROADING!

Engineered and constructed to meet the need of the U. S. Army Transportation Corps for a compact cargocrane for loading and unloading at embarkation docks, the LBS cargocrane will be available to you for more efficient handling of maintenance and stores materials. Rugged and having an astounding lifting capacity, the cargocrane is going to be a real favorite in post war railroading!
Write for special booklet No. 2033.

9713

LINK-BELT SPEEDER

Builders of the Most Complete Line of
SHOVELS-CRANES-DRAGLINES

LINK-BELT SPEEDER CORPORATION, 301 W. PERSHING ROAD, CHICAGO 9, ILL.
A DIVISION OF LINK-BELT COMPANY

A 25,000-Gallon Drink...

Quick!

LOCOMOTIVE 4007 is thirsty with a thirst that only 25,000 gallons of water can quench. A Fairbanks-Morse 12A Sheffield Standpipe does the job with the speed, efficiency and convenience demanded by today's railroading.

The Sheffield 12A has a telescopic spout that gives wide lateral and vertical range... convenient levers that permit rotation from ground or tender... operating rods that are easily adjustable... springs that eliminate shock... large roller that steadies spout... all rods outside of pipe, to provide easy adjustment.

In addition, this standpipe automatically locks from ground or tender... has no cable sheaves to clog with ice... rotates easily. Made in 8", 10", and 12" sizes, with capacities up to 6,000 g.p.m.

Since 1880 Fairbanks-Morse has supplied railroads with standpipes that are reliable, safe, and economical. Today this equipment is helping railroads meet the biggest schedule in their history.

Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois
Canadian Fairbanks-Morse Co., Ltd., Montreal

MEMBER 1944 NATIONAL RAILWAY APPLIANCES ASSN.

FAIRBANKS-MORSE

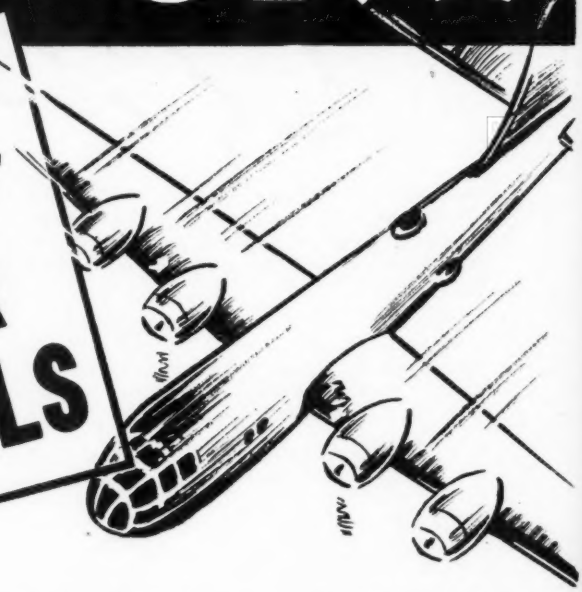
DIESEL LOCOMOTIVES • DIESEL ENGINES • MOTORS • GENERATORS
SCALES • PUMPS • STOKERS
RAILROAD AND FARM EQUIPMENT

Railway Equipment

BUY WAR BONDS

BOX CARS for B-29's!

. . . built better and faster with Thor AIR TOOLS



Helping major railroads rush on war-gauged schedules the vital new production of special-built steel box cars for transporting B-29 super-bomber wing sections is typical of the scores of jobs in car shops and yards being done *better* . . . *faster* with powerful Thor Air Tools.

Every type of Thor Air Tool for railroad shop use—drills, riveting hammers, rivet busters, grinders, wood borers, saws and many others—is being used to keep these giant wings and many other component plane parts *rolling* to west coast assembly lines.

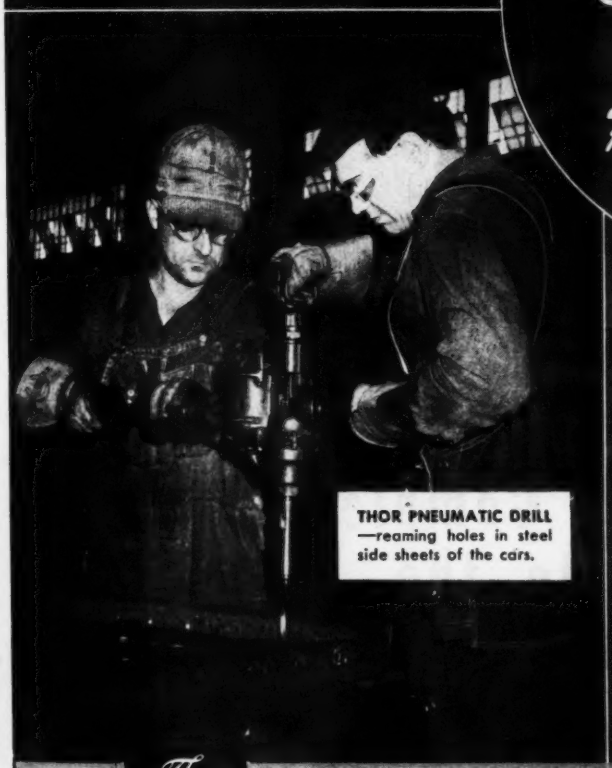
THOR WOOD BORER—boring bolt holes on running board atop cars.

THOR CLOSE CORNER DRILL—getting into a tight corner to drill holes in steel bridge support.

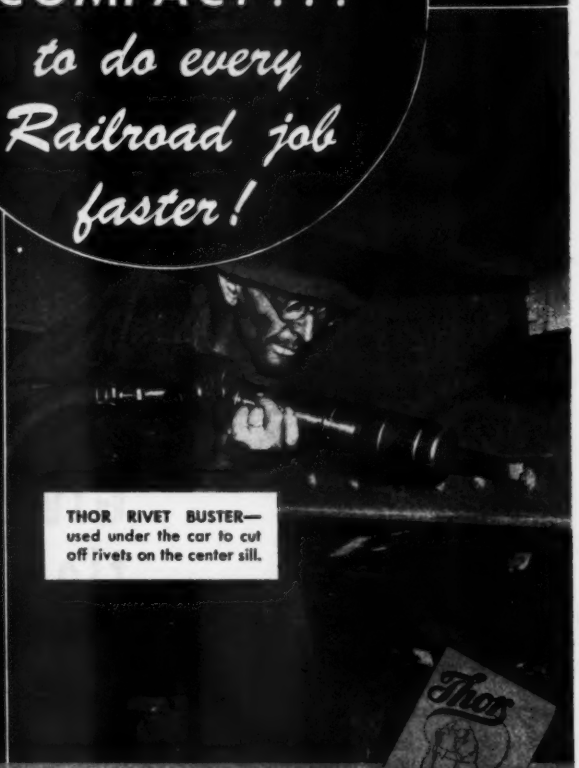
SPIKE DRIVERS	RIVETING HAMMERS	BALANCERS	
NUT SETTERS	GRINDERS	PAVING BREAKERS	CHIPPING HAMMERS
SCREWDRIVERS	ACCESSORIES	ROCK DRILLS	TAPPERS

THOR PNEUMATIC SAW—trimming off heavy planking along final assembly in the shop yard.

POWERFUL
YET LIGHT AND COMPACT . . .
to do every Railroad job faster!



THOR PNEUMATIC DRILL—reaming holes in steel side sheets of the cars.



THOR RIVET BUSTER—used under the car to cut off rivets on the center sill.

Thor Portable Pneumatic and Electric Tools

INDEPENDENT PNEUMATIC TOOL COMPANY

600 W. JACKSON BOULEVARD, CHICAGO 6, ILL.

Branches in Principal Cities

For complete information and specifications concerning all Thor Air Tools for speeding railroad car shop jobs, write today for Catalog 52-B.

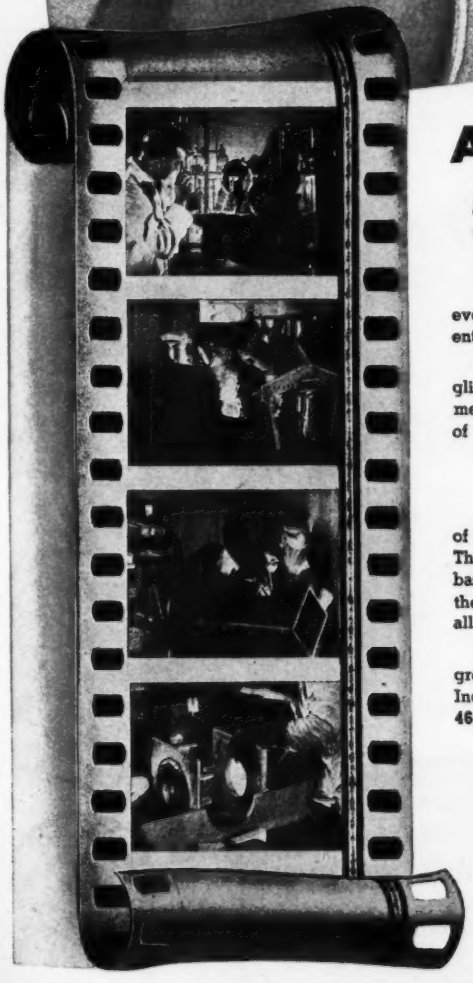
IMPORTANT

Schedule your requirements so that RMC PACKING will be on hand when needed.

Gives Complete Protection to the Rail Joint Area for Many Years

RAILWAY MAINTENANCE CORP.

PITTSBURGH 30, PENNSYLVANIA



A NEW 16MM. SOUND FILM

Here It Is! The Dramatic Story of Production Welding—Brought to You Via Motion Pictures

"New Horizons in Welding" is the first complete story of production welding ever to reach the screen . . . 30 fast-moving minutes of *sound* screen entertainment.

Here is the drama of the electric arc — the gleam that has grown from a glimmer — *grown 500 times in 10 years!* Here, too, is an education in the methods used to cut costs and speed production where welding has hit the peak of its development — in the fabrication of all-welded products.

An "Inside" Story — But Available to All

"New Horizons in Welding" is *really* an inside story . . . filmed in the plant of one of the world's largest *makers* as well as *users* of all-welded equipment. There you see the step-by-step procedure for welding on a mass production basis. *Every step,* from the birth of a project in the blueprint department to the host of labor-saving devices which speed it to completion — you'll see them all in "New Horizons in Welding."

P&H offers this absorbing, educational feature *without cost* to all interested groups — manufacturers, industrial schools, shipyards, government agencies, etc. Inquiries should be addressed to: Harnischfeger Corporation, Welding Division, 4606 West National Avenue, Milwaukee 14, Wisconsin.

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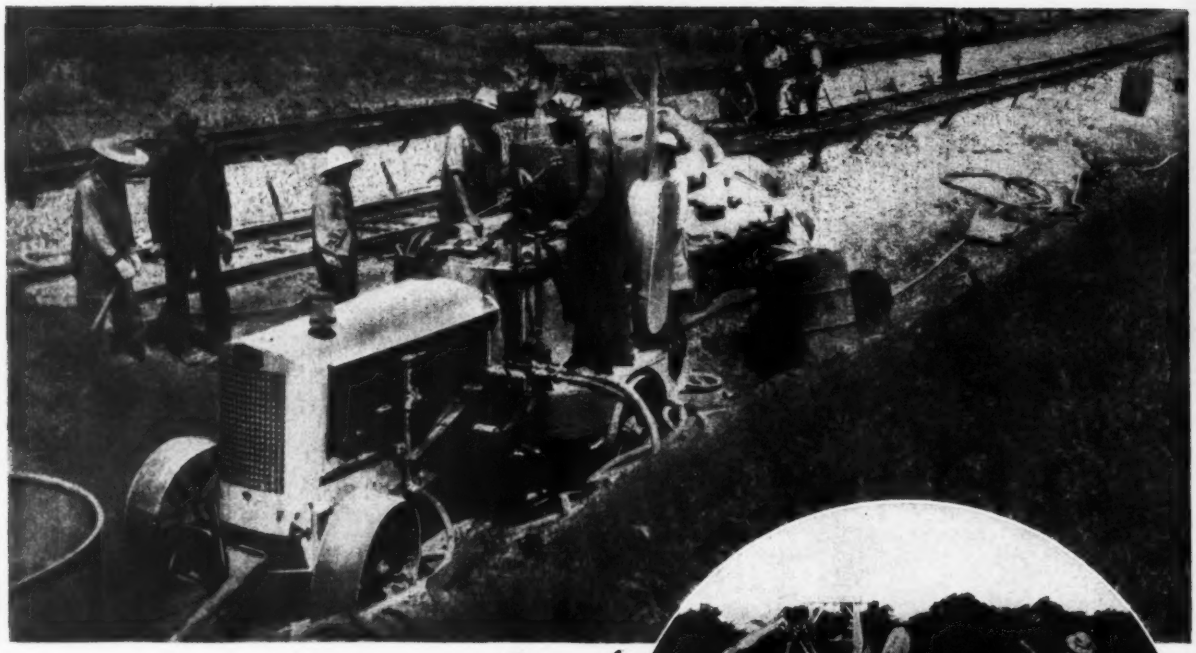
TRACK BED STABILIZATION



Koehring Mud-Jack Method

The method of track bed stabilization by which a slurry is pumped into the lower ballast or below the grade has become an important part of railroad maintenance. By this method the Koehring Mud-Jack forces the slurry through injection points which are driven into the section to be treated. Injection points are spaced at regular intervals, staggered from side to side and are always outside of the rail.

Train movement is not interferred with by the Koehring Mud-Jack Method of track bed stabilization. Water or other ballast pockets, loose fill conditions are corrected by this method.

Injection points are spaced and driven outside of rail to permit normal train movement.

Complete technical information about this method and its application to specific problems is available upon request.

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HEAVY DUTY

KOEHRING COMPANY • MILWAUKEE 10, WISCONSIN

HERE'S YOUR OFF-TRACK CREW

ONE MAN

ONE MACHINE

DROTT BULL CLAM SHOVEL

- **Does the work of a shovel, scraper, bulldozer, grader—handles complete off-track construction and maintenance from start to finish.**
- **Digs drainage ditches, builds up slopes, widens right-of-way—excavates, moves and dumps material without interference to traffic.**
- **Handles boulders; grubs and moves trees and stumps.**
- **Picks up and places railroad rails, ties, bridge beams, timbers.**
- **Always cuts smooth, leaving a level path for tractor to travel on.**

Gets capacity load, quick, in toughest going! No need to pick up Clam and carry—you skid it to dump on wearing plate—makes it easy on tractor and operator

DROTT

BULL CLAM SHOVEL FITS ALL MAKES and CURRENT MODELS OF CRAWLER-TYPE TRACTORS, from 30 to 130 h.p. Four sizes. 1, 2, 3 and 4 yd. capacities.

Operated by DROTT POSITIVE, CLOSED HYDRAULIC SYSTEM. SMOOTH • QUICK • DEPENDABLE

Keeps dirt and air out... keeps oil in! Used successfully on Drott equipment for many years.

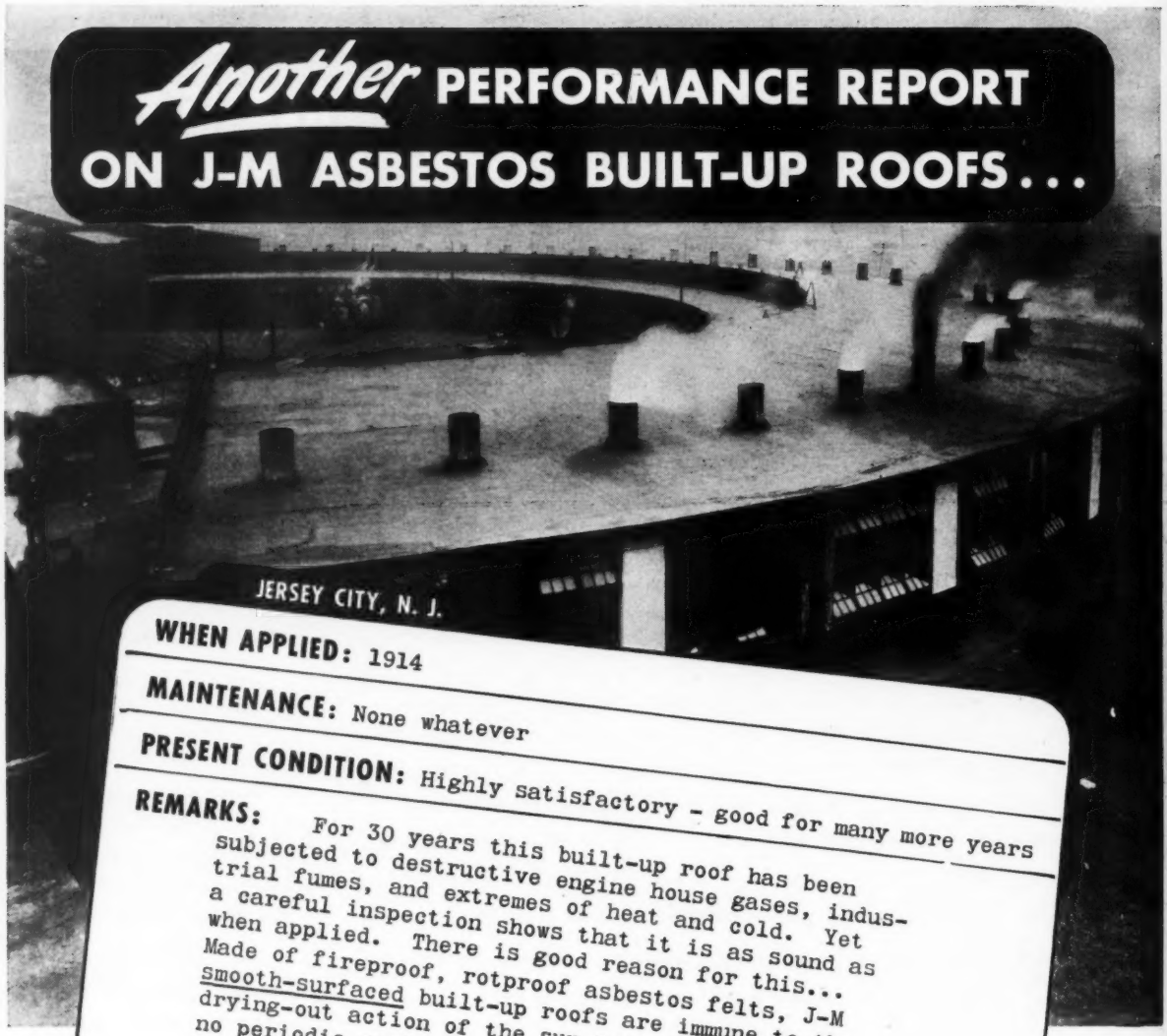
GET ALL THE FACTS!

Write for this book "Off the Rail Maintenance with the Drott Bull Clam Shovel" FREE!

DROTT EQUIPMENT

WRITE HI-WAY SERVICE CORPORATION

Another PERFORMANCE REPORT ON J-M ASBESTOS BUILT-UP ROOFS...



WHEN APPLIED: 1914

MAINTENANCE: None whatever

PRESENT CONDITION: Highly satisfactory - good for many more years

REMARKS: For 30 years this built-up roof has been subjected to destructive engine house gases, industrial fumes, and extremes of heat and cold. Yet a careful inspection shows that it is as sound as when applied. There is good reason for this... Made of fireproof, rotproof asbestos felts, J-M smooth-surfaced built-up roofs are immune to the drying-out action of the sun and, therefore, require no periodic coating. They give long years of low-cost protection against fire and weather.

Why J-M Asbestos Built-Up Roofs last so long!

J-M Asbestos Built-Up Roofs are constructed of alternate layers of asphalt and asphalt-impregnated asbestos felts. Unlike the fibers of ordinary felts, asbestos fibers are solid pieces of stone. They cannot act as "wicks" through which the sun can draw out the oils from the waterproofing asphalts. Actually, the asbestos felts provide a flexible stone covering for the entire roof area. This accounts for their extremely long life with no mineral surfacing, and with no periodic coating.

Scrape the gray surface of a J-M Smooth-surface Built-Up Roof. Regardless of its age, you'll find black asphalt underneath—proof that J-M Asbestos Felts do not dry out.

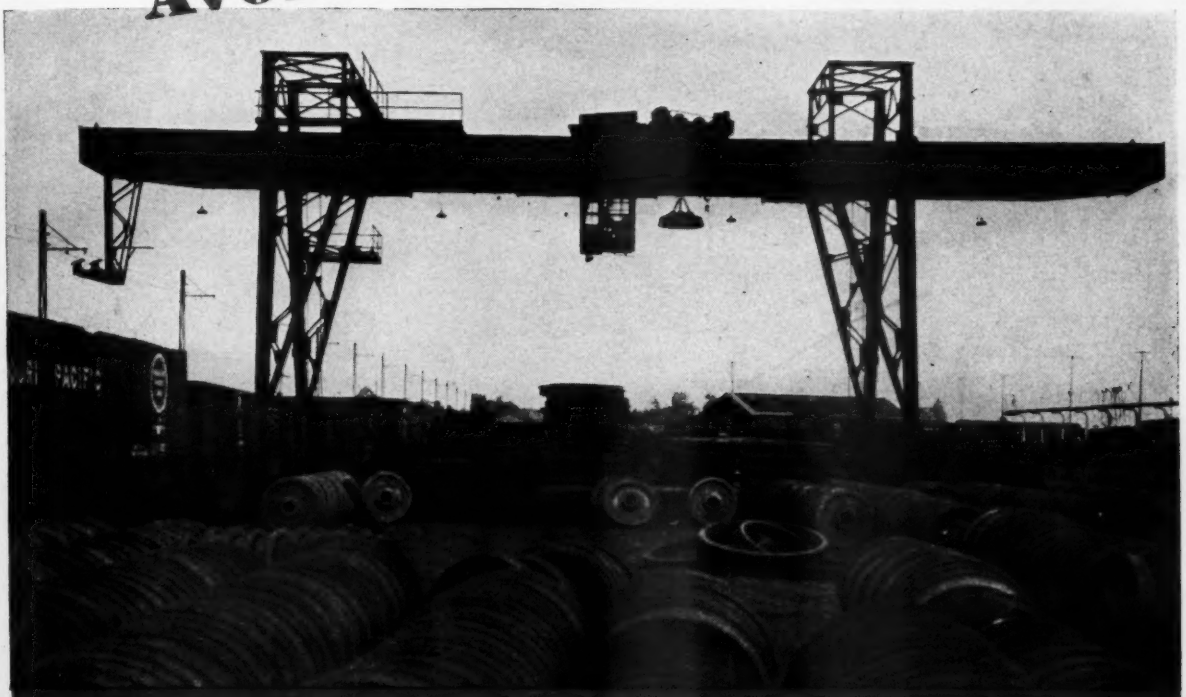
JOHNS-MANVILLE JM PRODUCTS

Johns-Manville

86 YEARS OF SERVICE TO TRANSPORTATION

Insulations · Packings · Friction Materials · Refractory Cement · Building Materials

Prevent Rust, Avoid Corrosion



with PRESSTITE Asphalt Waterproofing Mastic

Particularly adapted to the prevention of rust and corrosion of railroad equipment while in storage, Presstite Asphalt Waterproofing Mastic (No. 2390) is being used by America's leading railroads.

Designed for brush or spray application, this Presstite compound is a special asphaltic jell, cut-back type, furnished ready for use, and a very fast drier. It dries to a rubber-like, elastic film free from tack.

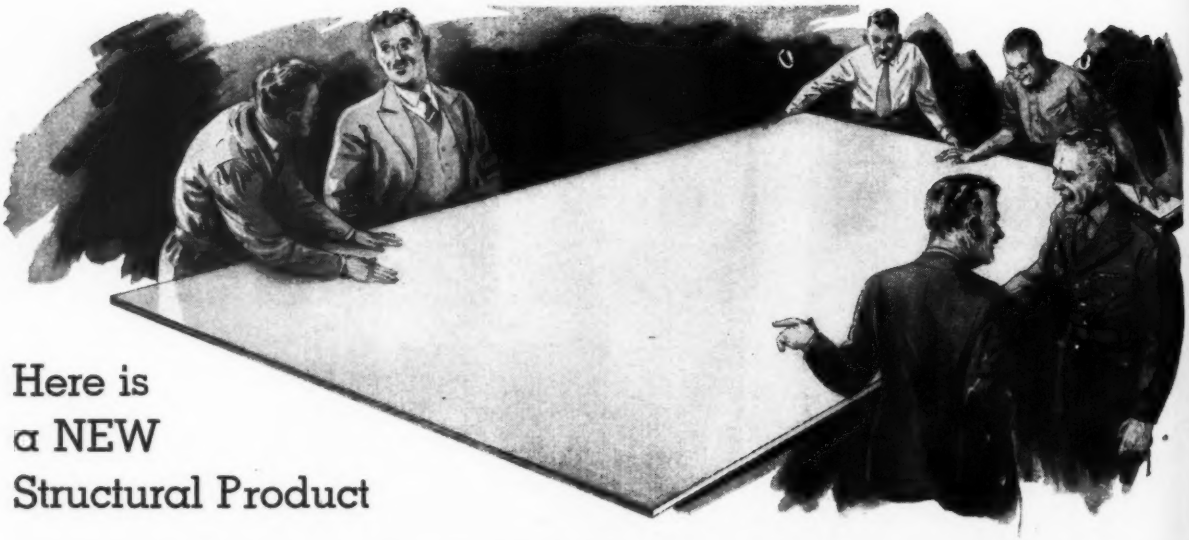
Protect *your* parts in storage — castings, trucks, wheels, and many other pieces of equipment — against destructive rust and corrosion with this specialized Presstite product. One of the largest roads in the country uses many thousands of gallons per year for this purpose.

Presstite sealing and coating compounds include many diverse types, each developed to meet a particular requirement. Send us your requirements and let our *sealing specialists* work with your engineers.

PRESSTITE SEALING COMPOUNDS

PRESSTITE ENGINEERING COMPANY

3964 Chouteau Avenue, St. Louis 10, Missouri



Here is
a NEW
Structural Product

INDERON

A High-Strength Material, in Large Panel Form, With a Smooth, Hard, Infrangibly-United Plastic Surface!

INDERON was developed as a utility container material for the Army Air Forces, was later adapted to many other war uses where strength, durability and dense, hard surface qualities were essential.

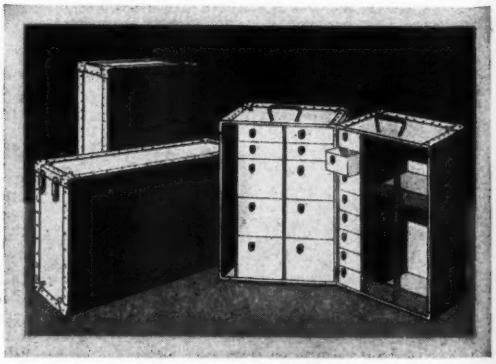
INDERON is waterproof, highly resistant to abrasion, impact, vapor permeation and other destructive forces. INDERON, made by chemically and infrangibly uniting Douglas fir veneers, plastic glues and a fibrous plastic film, is a large-size structural product which needs no surface protection, no decorative treatment, no structural support.

INDERON is stable. It does not warp or twist. It combines beauty, strength, durability and the economical panel form of standard plywood.

What Are the Uses of Inderon?

INDERON has literally thousands of applications in such fields as: Marine, Aviation, Railroad, Bus and Truck, Home, Office, Apartment, Farm and General Industry. Available now only for Army-Navy use. INDERON will become one of the most useful of all structural products in the post-war era. Write NOW for full information!

INDERON introduces a new formulation in the field of laminated plastics. To the hardness and the inert quality of the plastics is added an internal structure of resin-bonded veneer which adds strength and depth to the surface. This quality makes INDERON ideal for freight car siding, car roofs, trailer linings, shipping containers, coach floors—and for station fixtures, signs, etc. Investigate INDERON —now.



INDERON is successfully serving the Army Air Corps as the preferred material for packaging many vital parts, medical supplies and delicate instruments. INDERON has also been used for many other important war purposes and has proved its ability to resist tropical fungus, termites, weathering and water immersion.

Manufacturers

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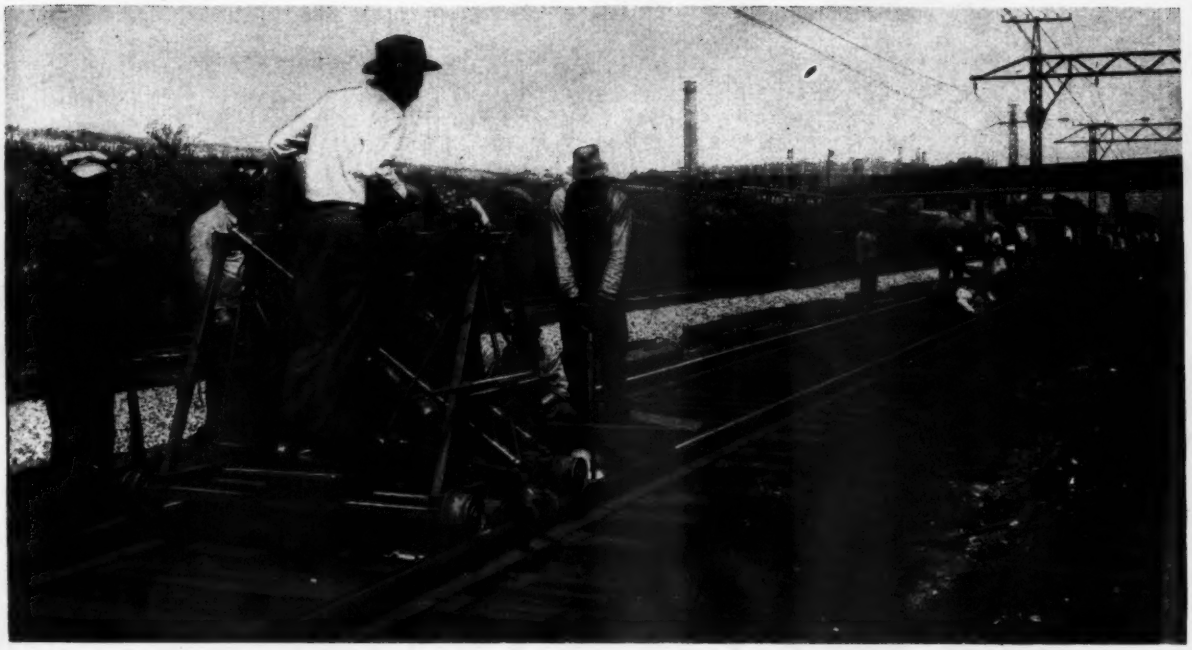
Washington Veneer Co.
Olympia, Washington

For Information, write
Chicago Sales Office
9 So. Clinton St., Chicago 6, Ill.



NORDBERG HYDRAULIC POWER JACK

for faster and more accurate lifts

The Nordberg Power Jack easily keeps ahead of the tamping gang. The hydraulic thrust cylinders permit of greater speed and accuracy of lift. Smooth action and simple controls assure better line and surface. There is no comparison between hand lifting and the Nordberg hydraulic way. Since it is faster in performance, quickly moved from lift to lift and requires less men, its use for ballasting and surfacing is essential in face of today's manpower shortage. The use of this Power Jack is just as advantageous on spot work as it is on heavy out of face raising.

Include a Nordberg Power Jack in your next year's budget. You will appreciate the features of this hydraulically operated machine.

Put these Nordberg power tools to work on your maintenance jobs

Power Jack
Adzing Machine
Spike Puller
Rail Drill
Track Wrench
Rail Grinder
Utility Grinder
Midget Grinder
Flexible Arm Grinder

NORDBERG MACHINERY

NORDBERG MFG. CO. MILWAUKEE WISCONSIN

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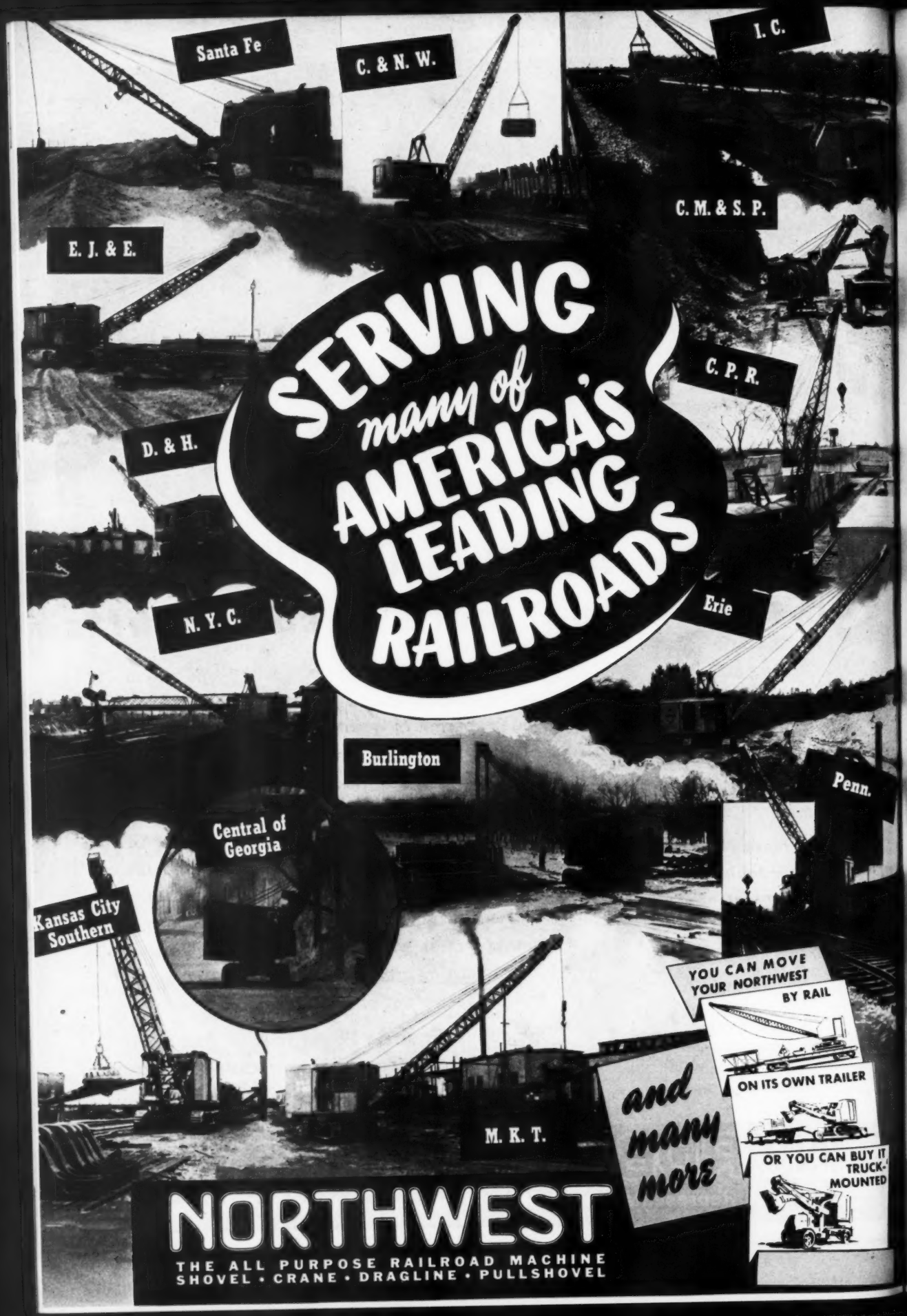
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YOU CAN MOVE YOUR NORTHWEST BY RAIL
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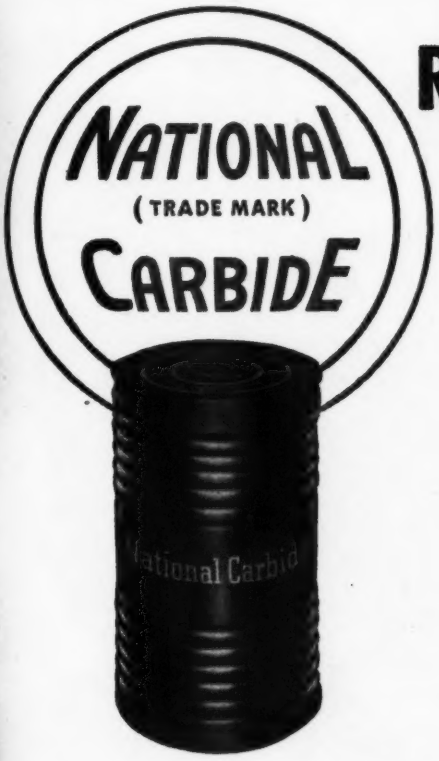
OR YOU CAN BUY IT TRUCK-MOUNTED
and many more
NORTHWEST
THE ALL PURPOSE RAILROAD MACHINE
SHOVEL • CRANE • DRAGLINE • PULLSHOVEL

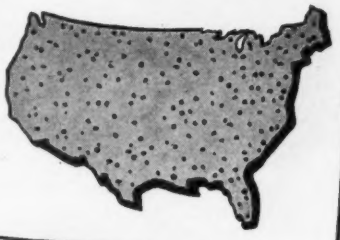


Rates "TOPS" with Industry

for these 3 important reasons

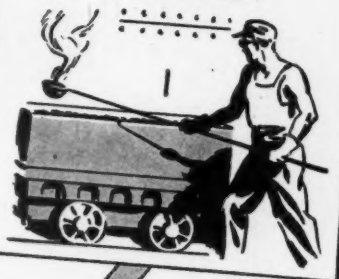
1. NATION-WIDE LOCAL DISTRIBUTION

Prompt deliveries in large or small quantities from more than 250 warehouses located in or near all major manufacturing centers. Also supplied by local dealers and distributors.



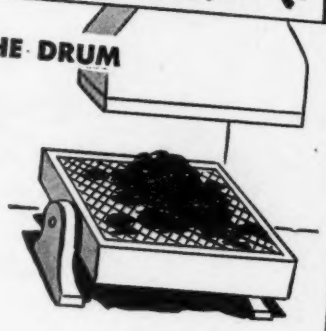
2. HIGH ACETYLENE YIELD ASSURED

Hourly testing and the use of exceptionally fine quality materials and strictly-controlled manufacturing procedures, produce a carbide practically free from impurities.



3. DUST-FREE IN THE DRUM

Because National Carbide is screened with extreme care. It is carefully packaged under strict supervision in air-tight drums in order to prevent contamination and deterioration.



You can depend on National Carbide—the famous "carbide in the red drum". More than a quarter century of widespread use has established the economy, uniformity and productivity of this quality carbide.

National Carbide is available in all sizes for generator use—packed in standard size drums. For the address of your nearest National warehouse or distributor, write to Air Reduction's New York Dept. REM.

BUY U.S. WAR BONDS

AIRCO ACETYLENE GENERATORS

Ideal Team-mates for National Carbide

For dependable volume production of acetylene, use National Carbide in Airco Acetylene Generators. Five sizes to choose from—15 lb., 30 lb., 50 lb., 300 lb. and 500 lb. single or double rated. The first three sizes are portable types and the latter two are stationary. These generators are listed by the Underwriters Laboratories, Inc. Write to Air Reduction's New York office for descriptive folder ADC 619, Dept. REM

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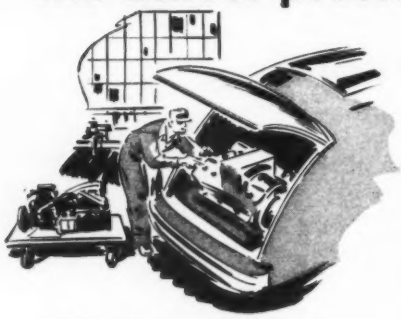
Offices in all Principal Cities

will deliver peacetime power for YOU tomorrow



FOR POSTWAR POWER

Andover Engine alone weighs just under 82 pounds. With generator and adapter only 116 pounds.

THIS auxiliary power unit, developed originally by Andover for use in military aircraft, has made a consistent record of dependable service not only on Uncle Sam's B-29 bombers but also on many other types of multi-motored airplanes.

Now Andover has ready for peacetime American industry a compact power unit which offers unlimited possibilities in every application for a portable source of power.

It can be used with generators to supply electric power on demand; it can readily be adapted to operate any mechanical apparatus where compactness and portability are desired and... of course... economy.

It can be easily mounted and transported. Indeed, its versatility will simplify operations in many peacetime industries.

Our informative booklet "Andover Auxiliary Power" may suggest how this motor can help you in the coming era of peace and expansion... yours for the asking.

Andover
AUXILIARY POWER

ANDOVER MOTORS CORPORATION • ELMIRA, N. Y.

WHOLLY-OWNED SUBSIDIARY OF ANDOVER KENT AVIATION CORPORATION

When OVERHEAD is UNDERFOOT...

It's a comfortable feeling . . .

To know that your overhead, underfoot, is under control . . .

To know that your flooring cost is low, and will stay low . . .

That your floors can stand heavy traffic, without undue wear . . .

That your floors are warm and shock-absorbent . . . help employees avoid fatigue.

That's why it's a comfortable feeling . . . when you walk across your Flintkote Mastic Floor.

Flintkote Mastic is *modern* utility flooring. It was designed and developed expressly for all industrial conditions from foot traffic to continuous steel-wheel trucking.

On station platforms, loading decks, stock car floors . . . anywhere you have heavy traffic . . . count on Flintkote Mastic Floors to give you long years of low cost service.

And a long shift on a warm, resilient Flintkote Mastic Floor is not as tiring as the same number of pounding hours on a floor that won't absorb shock.

That's a boost to employee morale . . . to customer comfort too.

You can cut maintenance and repairs to the bone with Flintkote Mastic. But if they do become necessary . . . the very characteristics of the Flintkote Mastic Floor make your cost surprisingly low . . . your job surprisingly simple.

Write for full information on the Flintkote Mastic Floor. Undoubtedly, your organization can use it to advantage.

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THE FLINTKOTE COMPANY

Industrial Products Division

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No. 191 of a Series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING CORPORATION
105 WEST ADAMS ST.
CHICAGO, ILL.

SUBJECT: Wanted, a Man.

November 1, 1944

Dear Readers:

Thanks for your many letters of congratulations and good wishes to the members of our staff as we reorganize and gird ourselves to carry on in your behalf in the months ahead. As these letters continue to come in, we are encouraged by their friendly and helpful tone, we are gratified by the regard expressed for our publication, and we are challenged by the high standards which you have set for us. We accept the challenge.

The co-operation which we have sought on your part, and which so many of you extend without measure, is greatly appreciated. That we solicit this co-operation has but one purpose, a purpose that can be achieved by no other means—that of being able to produce a better publication for you, with an endless stream of authentic articles and discussions on those constantly changing problems, practices and developments in maintenance of way and structures work that you want to be informed about—and when you want to know about them. Even with your wholehearted co-operation, it is essential that we have a fully-manned staff in order to be able to do our part adequately, and that is where our greatest need lies at the moment. Maybe you can help us.

To supplement and strengthen our staff, we seek a college-trained, energetic, personable young man, with a yen for railroading, a sound basic training in maintenance of way and structures work, and a bent for observing and writing. If there is such a young man on the railroads today, and we feel certain there are many, despite the drain of recent war years, there is a place awaiting him—a place offering an outlet for all of his qualifications—not in reporting to or serving a few railway officers on a single road, but in reporting and rendering a service to railway engineering and maintenance officers on every railroad of the country.

In asking for one of your men, we are not unmindful of the need of nearly every railway for man-power, and of the value that you may place on the type of man we seek, but we speak our need frankly to you, our readers, because it is among your ranks alone that such a man can be found, and because we are certain that, in the long run, it will be in the interest of all of you that our quest be successful.

Sincerely,

Neal D. Howard

NDH:ag

Editor

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

Growing in Favor with Maintenance Men

Verona
Fixed Tension
Triflex Spring
For Track Bolts

SINCE 1873

WOODINGS-VERONA
TOOL WORKS, VERONA, PA.

SINCE 1873

FOR A LONGER-LASTING PAINT JOB
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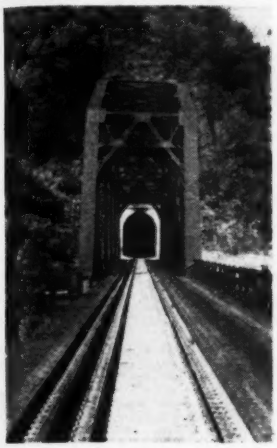

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Editorials - - - - - - - - - - - - - - - - - - 1013
Accidents—Labor Camps—Associations—Post-War Speeds

Asphalt-Cement Grouting Restores Roadbed on the Santa Fe - - 1016
Describes research and experiments leading to the development of this process, and also the gang organization employed to grout 106 miles

Southern Crops Rails with Special Torch Assembly - - - - - 1022
Discusses special device and methods developed for cutting ends of rail to make it suitable for relaying on secondary main lines

Rail Production Hits 14-Year High - - - - - - - - - - 1023
Annual statistics of American Iron and Steel Institute show appreciable increase in rollings of heaviest and lightest groupings during 1943

Bridge and Building Section - - - - - - - - - - - - 1025
Increasing the Capacity of Water Facilities to Meet Demand of Heavier Traffic
Recent Developments in the Treatment of Timber to Increase Its Fire Resistance
Keeping Work Equipment in Service
The Year's Developments in Labor
Post-War Values of War-Time Practices In Bridge, Building and Water Service Activities
Welding in Bridge, Building and Water Service
Bridge Inspection in the Light of Current Restricted Maintenance
New Possibilities in Building Designs and Materials

Bridge and Building Supply Men's Association - - - - - - 1048
A review of the activities of this organization, which has always been closely associated with the Bridge and Building Association

What's the Answer? - - - - - - - - - - - - - - 1049
Flangeway Fillers for Crossings
Bents for Trestles on Curves
When to Tighten Track Bolts
Repairing Power-Plant Chimneys
Dusting of Concrete Floors
Off-Season Use of Machines
How to Lay a Pipe Line
Who Should Grind Switch Points?

Products of Manufacturers - - - - - - - - - - - - 1056

New Books - - - - - - - - - - - - - - - - - - 1057

News of the Month - - - - - - - - - - - - - - - 1058

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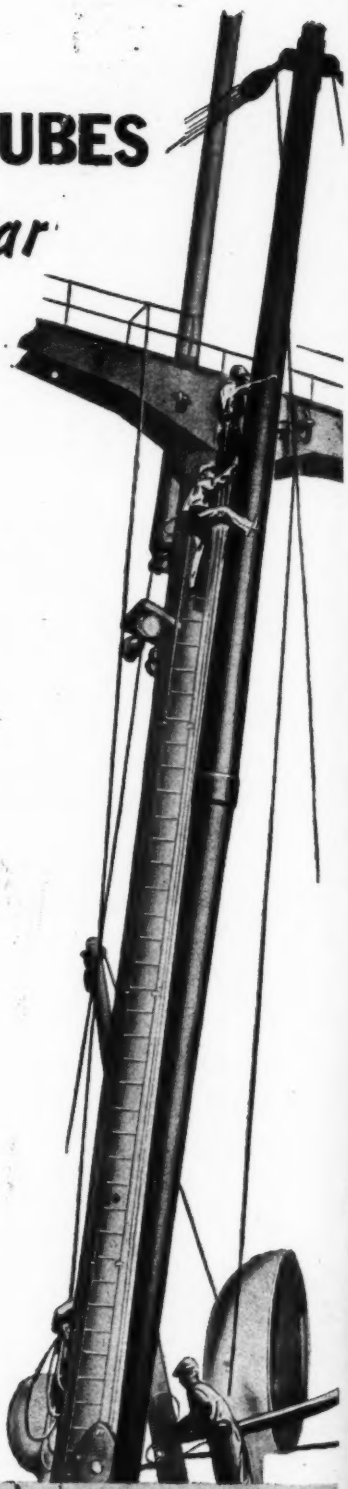
How We Made MONOTUBES SHIPSHAPE *for War*



LIKE most job-experienced engineers and contractors, you are doubtless familiar with the Monotube tapered pile... know how its lightness, strength, and extendability make cast-in-place piled foundations safer, faster, and cheaper to install. But have you heard the story of how Monotubes went to sea?

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Monotube Tapered Piles

Railway Engineering and Maintenance

Accidents—

The War-Time Record

Since the onset of the present World War, the railways have broken all previous records for carrying capacity, service and efficiency, with overall performance which, according to Director J. Monroe Johnson of the Office of Defense Transportation, "is amazing the nation." While this has been taking place, what has been their accident record?

Contrary to what may be the popular belief as the result of the wide publicity given the few serious train accidents in recent years, the fact is, that travel on the American railroads in 1943 was three times safer than it was during the first World War. In the two-year period 1917-1918, when the railroads performed 83,312,000,000 passenger miles of service, the total number of fatalities to passengers from various causes was 772, or one for each 107,917,000 passenger-miles of service performed. In the two-year period 1942-1943, they performed 141,721,000,000 passenger-miles of service, and total passenger fatalities in those years, due to all causes, was an even 400, or at the rate of one for each 354,303,000 passenger-miles of service performed.

This is a remarkable record, of which the railways can be justly proud, but good as it is, railway officers and employees would deceive themselves if they did not face all of the facts, which indicate unmistakably that since the onset of the present war, the downward trend in accidents among passengers and employees has been reversed. In 1943, a total of 281 passengers were killed in all kinds of railway accidents, compared with 87 in the pre-war year of 1940; and a total of 5,125 were injured, compared with 2,583 in the earlier year. Total passengers killed and injured, combined, in these two years, respectively, were at the rate of 61.54 and 112.11 per billion passenger-miles, a highly creditable record in this respect.

As to employees, there were a total of 1,089 killed and 45,685 injured while on duty in all kinds of accidents on the railways in 1943, compared with the total of 600 killed and 17,836 injured in similar accidents in the pre-war year of 1940. Total killed and injured, combined, in these two years, respectively, were at the rate of 12.67 and 7.27 per million man-hours worked. These are the records of recent war years.

That maintenance of way and structures employees are directly involved in this matter is seen in the fact that, whereas in 1940 there were 774 train accidents due to defects in or improper maintenance of way and structures (10.89 per cent of the total), there were 1,902 train accidents due to the same causes in 1943, representing 11.84 per cent of the total. That maintenance of way and structures employees are involved in this matter is seen also in the fact that among such employees on the Class I railways, fatalities jumped from 109 in 1940, at a rate of 0.221 per million man-hours, to 259 in 1943, at a rate of 0.353 per million man-hours, and the number of employees injured jumped from 3,465 in 1940, at a rate of 7.10 per million man-hours, to 7,026 in 1943, at a rate of 9.73 per million man-hours.

These records of railway accidents in the present war period are less savory than the comparison of their accident records in the two war periods, and should be a matter of concern to every employee. In fact, that the recent reversal of the accident trend should take place during the greatest emergency ever to confront our country, when every man-hour is at a premium, may well be viewed with alarm, unless arrested, and arrested promptly. That it be arrested is the personal responsibility of every railway officer and employee, and those in the maintenance of way and structures department must share that responsibility in a large way.

Labor Camps—

Will They Bear Public Inspection?

AT THE opening meeting of the Maintenance of Way Club of Chicago for the current season, a few nights ago, engineering and maintenance officers of the Pere Marquette told members of the club of their experiences in the employment of high-school boys on track work during the summer. Among other things, they related how they had brought a complete mobile camp into one of the larger towns along the line, in which boys were being recruited, and placed it on exhibition close to the business district. The primary purpose of this was not only to stimulate interest among an increased number of boys, but to assure parents that the boys would be well taken care of during the period of their employment.

Advertisements announced that the cars would be open for inspection from 1 p.m. to 7 p.m. on a given day, and members of the families of the boys, their friends and the school authorities were invited particularly to visit the camp and inspect the cars. However, everyone was assured a welcome who might be interested in seeing the quarters the boys were to occupy during the summer.

Forty-nine boys were to be housed in the camp on display, and the railway officers had expected that the families of these boys would be out in force, but that beyond this and a few school officers and teachers, and a few personal friends, there would be only mild curiosity elsewhere. Imagine their surprise, then, to have a total of more than 3,000 persons, a capacity crowd, make an interested inspection of the cars during the six hours they were open. The testimony was definite that the motivation for these visits transcended mere curiosity, being founded on real interest. Without realizing in advance that they were going to rouse so much interest, they had created a real bit of excellent and favorable publicity for the railway.

This incident arouses speculation as to how many roads would be willing to subject their mobile camps to a similar inspection, and the kind of publicity they would get if they did so. The testimony is general that labor camps are better today than at any time in the past, and that the sanitary conditions surrounding them have been improved measurably, compared with a few years ago. Yet, observation indicates that relatively few such camps would be able to make the favorable impression that was made by the Pere Marquette camp, which was composed of refitted freight cars that were picked from a lot that was being retired.

Materials are now available that, at relatively small cost, will make camp cars both more attractive and more comfortable. Electric lights can be installed and hot and cold running water can be provided, while not a few camps now have shower baths. Some roads have installed electric refrigerators to insure that food will not spoil, and thus permit it to be bought in larger quantities. A few camps now have lounge cars with games as a part of the provision for the comfort and amusement of the men.

One road has made it a practice, as its older passenger cars are retired in favor of new light-weight equipment, to assign the discarded cars to camp-car service, and thus has greatly improved the housing of at least a part of its men. In the post-war period, much of the existing passenger equipment will be replaced with modern, streamlined designs and the older cars will go into the discard. In that period, more maintenance officers should give serious consideration to converting this discarded equipment into cars for mobile camps.

Associations—

Is Your Road Getting the Most From Them?

IS your road well represented in—and getting the most out of—the Roadmasters' and Bridge and Building Associations, the two outstanding national associations representing those who have direct responsibility in the field for the adequate maintenance of the tracks, bridges, buildings, water service facilities and other elements of the fixed properties of the railways? If this question cannot be answered in the affirmative, your road, many of the men on your road, and you personally, are sustaining a serious loss.

For more than fifty years, acting within their own specific spheres of influence, these associations have made yearly contributions to the technic and efficiency of roadway and structures maintenance, contributions which have been of inestimable value to the railways and to those in their roadway and structures departments. Evidences of this is contained in the annual reports of these associations for many years in the past, and is seen anew in both the 1944 reports of the Roadmasters' Association, which were published in the October issue of *Railway Engineering and Maintenance*, and in the current reports of the Bridge and Building Association, which appear in a special 24-page section in this issue. And the future, with its certain demands for higher standards of maintenance, efficiency and economy, in order that the railways may hold their dominant place in the transportation of the country, makes it imperative that the valuable work of these associations continue, with greater and more widespread influence than in the past.

No one seems to question the value of these associations—the Office of Defense Transportation, the Association of American Railroads, railway officers in general, and railway engineering and maintenance officers, in particular. In fact, while both the O.D.T. and the A.A.R. recommended against the annual three-day meetings of these groups during the current year in the interest of relieving the load on train travel, both have urged that their activities be carried on aggressively through committees. This will be done, and as aggressively as possible. However, with indications during the last year or two that many members are losing touch with the associations by reason of war conditions, the pressure of their enlarged responsibilities, and, more

particularly, the cancellation of annual meetings, it is becoming increasingly evident that this will be done under serious handicaps, unless members and those who should be members are stimulated to greater interest in association work.

No one on the railways can supply the needed stimulus better and more effectively than higher engineering and maintenance officers. One way for them to do this is to join the associations themselves and thus, by example, create greater interest among their supervisory officers —and there have been notable examples of the value of this form of stimulus in the past in both associations. Another is for these officers to encourage their men to be active in association committee work, and to allow them the time and facilities necessary to this end. In the last analysis, how active their men will become depends upon the men themselves, but it is well known that there are many roadway and bridge and building supervisory officers who are not active because they sense no encouragement or support from superior officers.

Where this situation prevails, it should be corrected—not in the interest of the associations, as such, but rather in the interest of the railways, through the value to be gained through the associations, and which can be gained in no other way.

Post-war Speeds—

Will Demand Much Roadbed Stabilization

WHILE maintenance and engineering officers are fully occupied with the many duties and problems involved in maintaining their tracks and structures so that the present heavy volume of war traffic can be kept rolling without delays, many are thinking more and more of post-war maintenance problems and trends. Practically all of these officers agree that one of the principal postwar developments on the railways will be an increase in speeds of both freight and passenger trains to improve service and to meet competition. They are not so uniformly in agreement as to what ultimate speeds will be attained, but it is well known to them that with modern power and streamlined equipment, passenger train speeds as high as 120 m.p.h. are possible and are being considered seriously. However, whatever the top speeds may be, it is certain that on nearly all main lines, passenger train speeds as high as consistent with safety of operation will be the rule, rather than the exception, and that freight train speeds will not be far behind.

From the standpoint of engineering and maintenance officers, this will mean that there must be a continuation, and even a large expansion, of programs of curve reduction. In addition, servicing facilities en route, if not already modernized, will need be improved to reduce delays to a minimum.

The primary factor affecting post-war speeds, however, will be the standard of maintenance of the track structure itself. The refinements in track surface that will be necessary for speeds in excess of 100 m.p.h., for example, will require a vast amount of roadbed stabilization—otherwise the cost of maintaining such refinements will be excessive, if not prohibitive.

On every road there are many miles of unstable roadbed, which are a result of poor soil, poor construction methods or bad drainage conditions. While it is possible today, with modern equipment and proper attention to drainage and to specifications regarding soil mixtures, moisture content and compaction, to construct roadbeds that do not have these faults, the fact remains that much existing roadbed was constructed many years ago in a manner which permitted unstable conditions to develop.

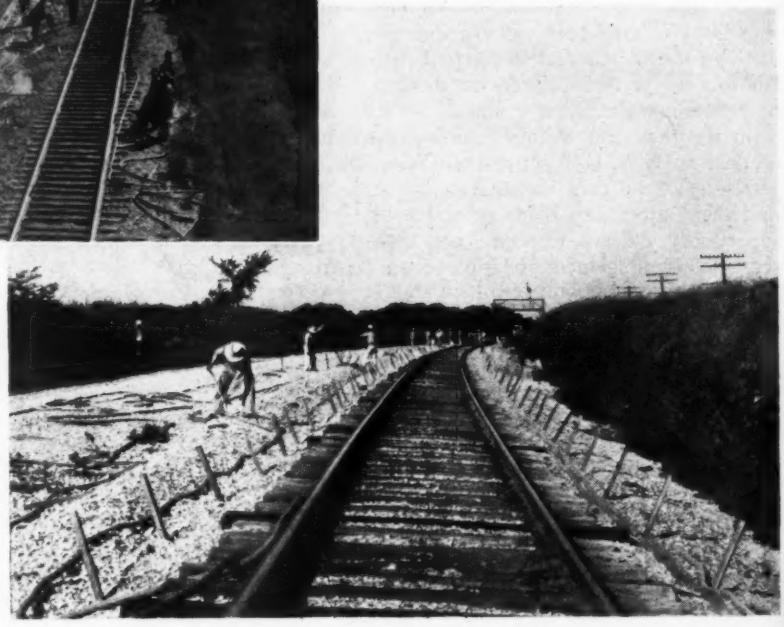
There are numerous ways of combatting unstable roadbed. One is to drive poles or old ties at the ends of the track ties; another is subdrainage. Subdrainage has been employed for many years with varying degrees of success, first in the form of French drains, and later with pipe drainage systems of tile and corrugated metal pipe. To be successful, subdrainage must accomplish one or both of two objectives. It must intercept water from outside sources and prevent it from getting into or beneath the track, and it must remove all water from pockets under the track. Adequate systems of subdrainage may be expensive, but they are effective and the cost is usually repaid many times over. Less than adequate systems of subdrainage usually serve only as temporary stop-gaps.

More recently, another method of stabilizing the roadbed—the grouting of the subgrade or the sub-ballast—has been tried on several roads. In one type of grouting an effort is made to establish a strong sub-ballast slab under the track to distribute the load of traffic more generally over the unstable area. In another, which is described in the leading article in this issue, the purpose is to fill all water pockets and minor voids, and thus restore the roadbed to its original condition from a drainage standpoint. Tests of these later methods have not been in existence long enough to determine their ultimate success, but results to date indicate that either or both of them may constitute an important advance in the art of combatting unstable roadbed.

In any event, whatever methods may be used, and there are others than those mentioned, including the use of precast concrete sub-ballast slabs, timber mats, longer crossties, drainage tunnels, etc., each with advantages under specific conditions, it is certain that a vast amount of roadbed stabilization will be necessary after the war if the railways are to exploit economically the ultimate possibilities of high-speed train service.

Poster No. 254, October Installment of the "All the Year-Every Year Safety Program," Which is Now Being Distributed by the Committee on Education, Safety Section, A. A. R.

Asphalt-



Above—General View of Main-Line Grouting Gang. Right—Showing Stakes Set in Holes Driven by Bullpoints But Not Yet Grouted

As the result of nearly three years of research and experiment, the Santa Fe has developed new methods and equipment for cement and asphalt-cement grouting to fill water pockets and restore the roadbed to its original stable condition. This work is now past the experimental stage, and so far during this present year 71 miles of tracks has been grouted at an average cost of about 62 cents per track-foot. The development of this type of grouting and the methods and equipment employed are described in this article

IN December, 1941, the Atchison, Topeka & Santa Fe began experiments on pumping cement grout into the subgrade to fill water pockets and to restore the original drainage condition of the roadbed. Unlike previous experiments with sub-ballast grouting on several other roads, the Santa Fe has not tried to establish a strong concrete blanket or slab under the track, but rather has attempted only to fill water pockets in the subgrade with a self-sealing material which will force out existing water and prevent its future accumulation under the track. In the course of nearly three years of work, it has conducted much research and hundreds of experiments to develop the best mixtures of material and the best equipment for accomplishing this purpose. The latest result has been the development of a method of asphalt-cement grouting, using a very fine "blow" sand and specially designed mud jacks for pumping the grout under track. The grout is injected into the water pockets through grout or "mud" points 6 to 12 ft. long, which are driven beneath the track at an angle from points near the ends of the ties. The results have been so satisfactory that 18 grouting machines are now being employed at various points on the system between Kansas City, Mo., and the West Coast, and more than 106 miles of tracks have been stabilized to date on the road as a whole.

Early Experiments

For a number of years the Santa Fe had tried various methods of filling water pockets with "blow" sand, but with little success. From previous experience, it was kown that such pockets could be stabilized by digging them out by hand and backfilling them with this sand, a very fine drifted, or air-borne sand, of which there is a plentiful supply at many points along the lines of the Santa Fe west of Kansas City. In the early experiments attempts were made to blow dry sand into water pockets, and also to force it in with air pressure, but these methods were not successful. Subsequently, a grout-mixture of "blow" sand, cement and water was tried.

The first trial of grouting the subgrade was made in December, 1941, when two very troublesome water pockets 200 ft. long, near Slaton, Tex., were grouted, using a tank and mortar box, and mixing the grout by hand. The grout was blown under the track by 100 lb. of air pressure, using an ordinary air compressor from a tie tamper outfit. In this work a variety of mixtures were used, ranging from one part of cement with six parts of sand, to one part of cement with 13 of sand—in each case with about 8 gal. of water for each cubic foot of dry material. These mixtures were much leaner than the 1 to 1 and 1 to 2 mixtures that had been used by other roads to establish a solid block of concrete under the track.

The primary purpose of the cement in the initial Santa Fe method was to serve as a lubricating agent, enabling the grout to penetrate and fill all the voids in the water pockets, and throughout all succeeding work this same objective has been the primary consideration. While the resulting grout, after it sets up in water

Cement Grouting

Restores Stable Roadbed on the Santa Fe

pockets, does not have much strength in shear or tension, it has some strength in compression. More important, the cement grout, and the asphalt-cement grout, developed later, are apparently self-sealing, and thus continue to serve their purpose in maintaining a water-tight subgrade, despite vibration from traffic.

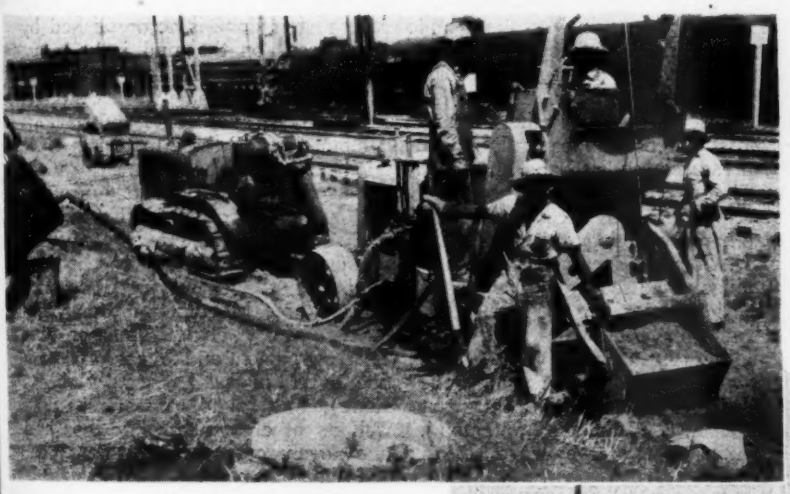
Good results were obtained from the first tests of grouting, but the method used had two serious disadvantages, which were immediately apparent. When the grout tank became empty, the air would blow the ballast out from between the ties, destroying the tie bed and occasionally raising the track out of surface. In addition, the process of mixing the grout by hand, placing it in the tank, etc., were slow and expensive, and only about 100 track-feet a day could be grouted with a force of one foreman and 6 to 8 laborers. For these reasons, the pneumatic method was abandoned and a system of hydraulic pumping was developed.

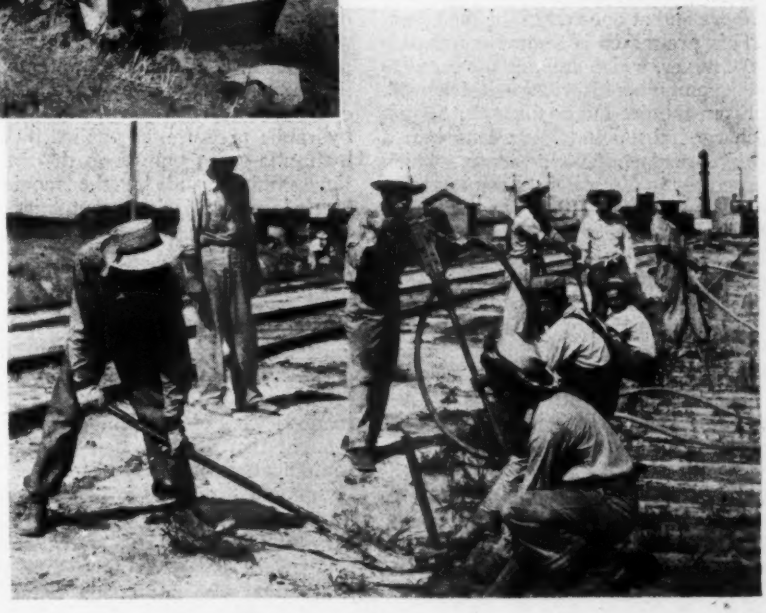
The first hydraulic grout pump was designed by Santa Fe engineers and was built in one of the road's shops. This unit was completed in March, 1942, and was immediately used to grout a number of water pockets on a section of main line in northern New Mexico. With this pump, the grout was still mixed by hand and was poured into a hopper on the pump. However, the pump itself worked satisfactorily, demonstrating the practicability of this method of forcing the grout into the roadbed. It was then decided to build a complete grouting machine as a unit, incorporating the hydraulic grout pump as a part.

First Complete Grouting Machine

A 35-hp. crawler tractor was selected, which already carried a 140-cu ft. air compressor, and upon this were mounted two horizontal pug-mill type mixers, which were operated at rather high speeds, and a 1½-in. rotary water pump with a capacity of 35 gal. per min. In addition, the previously-built grout pump was also mounted on the tractor, making the unit as a whole a completely self-contained, self-propelled, grout mixing and pumping machine.

Given its original test near Thatcher, Colo., on May 20, 1942, this machine proved very successful. Since that date, it has been used for 22 months during the last two years at various localities in Colorado, New Mexico and Texas for grouting water pockets containing ballast ranging in





Yard Track Grouting at Wellington, Kan. Above —A Mud Jack and Tractor. Right—Pulling a Bullpoint and Driving a Mud Point

size from fine rock screenings up to standard crushed slag and rock. Up to a recent date, it had already pumped 7,838 cu. yd. of grout (dry measure) in 31.015 miles of main track, at an average cost of less than 50 cents per track-foot. This cost included everything except supervision and depreciation of the equipment, which charges, it is estimated, would add approximately two cents to the cost per track-foot. During its use, this machine has stabilized an average of about 300 track-feet per day, but the fact that performance on individual days fluctuated from 40 track-feet to 1,176 track-feet, gives an indication of the variety of conditions encountered.

After the success of the first complete grouting unit had been established, three machines of similar design were built for use on the Eastern Lines and one machine was built for use on the Gulf Lines. In 1943, the Koehring Company, Milwaukee, Wis., became interested in this work and made studies to determine if its highway mud jacks (designed for raising low places in concrete pavement) might be adapted to track grouting. After some consultation and trial, the Koehring mud jack was modified for track grouting work and the Santa Fe purchased 13 of these machines during 1943 and the first half of 1944. The principal modification made in the mud jacks was the substitution of grout pumps with 6-in. cylinders, instead of those with 8-in. cylinders.

The Koehring Mud Jack

The Koehring mud jack is powered by a 28-hp. gas engine and has a skip hoist at one end which holds 4 cu. ft., level full, or 5 cu. ft. heaped. The skip hoist dumps into a pre-mixer mounted above and at one end of the mud jack. This pre-mixer is a slow-speed paddle mixer, which agitates the grout to the point where it will flow fairly well. From the pre-mixer the grout is discharged through two screens into a high-speed paddle-type mixer, which operates at 600 r.p.m. From the second mixer, the grout is discharged through a final screen of about ⅛-in. mesh, directly to two grout pumps. The grout pumps have specially-designed pistons which deliver the grout in a series of pulsations. Ordinarily each pump discharges into a separate hose line and will develop a maximum pressure of 450 lb. per sq. in. The machine is also equipped with a rotary water pump with a capacity of 35 to 50 gal. per min.

Unlike the tractor-mounted grouting machine developed by the Santa Fe, the mud jacks are not self-propelled and are usually hauled by a 35-hp. tractor, which carries a 140-cu. ft. compressor. In some cases, portable compressors are also used.

In addition to the hydraulic grouting machines, other equipment was also developed for this work. The design and construction of the grout, or mud points, and the size of the hose for the grout lines, were found to have a considerable influence on the rate of progress of the work, its cost and its effectiveness. Ordinary steel pipe can be used for mud points, but seamless alloy steel tubing, of about 13/16-in. inside diameter has been found ideal for this purpose. The mud points have an integral point, closing the lower end and a driving head equipped with a nipple to which a hose with a "glad hand" coupling can be quickly applied. At the lower end of each mud point two ⅝-in. holes are drilled on opposite sides, one about one inch above the other, for ejecting the grout into the ballast or subgrade. To avoid delays in driving the mud points, and to save wear and tear on them, it is almost always advisable to drive and remove bullpoints in advance. The bullpoints must also be of high-grade steel to withstand impact and abrasion. Both types of points can be driven by various means, but pneumatic paving breakers and spike drivers, with modified socket heads, have been most satisfactory.

Heavy-duty, five-ply, 1¼-in. air hose is used for the grout lines. Lighter hose will burst frequently under the pressures required and hose of a smaller or larger size does not work as well. With the exception of the "glad hand" coupling at the mud point nipple, Chicago Pneumatic or similar couplings are used for other joints in the hose lines.

Grout must not be allowed to stand in the hose lines more than a minute or two. If the machine must be stopped for a longer period, the grout must be flushed out with water and, in winter, the water blown out with compressed air. With the pulsating hydraulic pressure, as applied by the hydraulic grout pumps on the Santa Fe machines and by the modified Koehring mud jacks, grout lines up to 250 ft. in length can be used.

More Research

While the Santa Fe was developing its track-grouting equipment, experiments with the type of grout or other material to be pumped into the roadbed were also continued. It was thought that with properly designed equipment it might be possible to pump fine sand and water into the water pockets, without using cement. Mixtures of sand and water, however, were hard to pump and the penetration was not good. In addition, this mixture wore out the equipment much faster than grout. Mixtures of fine-grain top soil and water and of cement grout ranging from 1 part of cement and 4 of sand, to 1 part of cement and 40 of sand, were also tried. It was finally decided that the best mixture was a grout of fine sand and cement varying from 1 part of cement to 6 to 13 parts of sand.

The type of sand used has a considerable bearing on the ease of pumping. The best sand found has been one in which 100 per cent passes a 14-mesh sieve, 90 per cent passes a 48-mesh sieve, 22 per cent a 100-mesh sieve, and 3 per cent a 200-mesh sieve. In general, a very fine sand with about 90 per cent passing a 48-mesh sieve and about 20 per cent passing a 100-mesh screen will flow into the voids best with the least amount of pumping difficulty, and with the least wear on the pumping equipment. A number of sands of approximately this consistency were found in various locations along the Second district of the Eastern Lines and along the Western Lines. On the Coast Lines, fine sand has been secured from quicksand streams. The sand is not screened or washed before mixing; what screening is done is accomplished by the screens on the mud jacks.

In addition to sand, many types of soil materials, mine wastes, sludge, loams, clays, adobe silts and various combinations of these materials were tried with standard cement, quick-setting (alumina) cements, and mortar or masonry cements. Earth, clay and Bentonite materials were not found to be very satisfactory because they will not take a set in the presence of moisture. Mortar or masonry cement, which is roughly 50 per cent Portland cement and 50 per cent very fine inert material (usually limestone), was found to work just as well as other cements and has the two advantages of slightly less cost and lighter weight (65 to 84 lb. a sack, as compared to 94 lb. for Portland cement).

Early in 1944, in co-operation with the Texas Company, much laboratory work was done on the idea of combining asphalt and cement for use in the grouting work. These experiments were started despite the fact that many thought that these two materials could not be combined successfully. The laboratory experiments, however, were favorable and these were continued in the field, using a standard emulsified asphalt. Again, many different combinations were tried, and at first too much asphalt was used so that the grout stayed rubbery. However, it penetrated the voids readily and stabilized the track.

Standard emulsified asphalt set too

Another Main-Line Grouting Set Up—Men in Between Tracks Are Driving a Mud Point

slowly, however, and a new quicker-setting emulsion was obtained. This emulsion consisted of about 60 per cent asphalt and 40 per cent water, with small amounts of chemicals which caused the emulsifying action, and which controlled the "breaking" or setting time and the amount of foaming and settlement. This new emulsion is very finely subdivided. Experiments with this asphalt emulsion were also conducted with a variety of soil materials, including various sands, to which were added, separately or together, Portland cement, mortar cement and Bentonite. Finally, Bentonite was discarded, as well as all other soil materials, except sand, and final specifications for an asphalt-cement grout were developed, somewhat similar to those for cement grout, as follows: One part of Portland or mortar cement to 6 to 20 parts of sand; 1/5 to 1/10 gal. of emulsified asphalt for each cubic foot of sand; and approximately 4½ to 8 gal. of water for each cubic foot of dry material.

After the development of this specification, all grouting operations were changed to the asphalt-cement formula, because with it the same penetration can be secured with a leaner mixture, and it has even better self-sealing properties. To change to the asphalt-cement specification, each grouting machine was equipped with a single-cylinder, double-acting, hand force pump, used to pump the asphalt emulsion from a barrel into the pre-mixer on the mud jack. One stroke of this pump in one direction injects about ½ gal. of asphalt emulsion into the mixer.

In asphalt-cement grouting, as in straight cement grouting, the mud jack operators were instructed to use the leanest mixture, within the limits assigned, which can be pumped readily and which will penetrate the voids satisfactorily. If trouble is encountered in filling these voids, more cement and asphalt are used in the mix for lubrication.

Out-of-Face and Spot Grouting

Of the total of 18 grouting machines now on the Santa Fe system, the Eastern Lines have eleven, including three home-made and eight Koehring; the Western Lines have four, of which one is home-made and three are Koehring; the Gulf Lines have one home-made; and the Coast Lines have two Koehring. In organizing to do this work, the Western, Gulf and Coast lines have a gang for each machine and follow spot-grouting programs. On the other hand, ten of the machines on the Eastern Lines have been kept together and have been used on a large out-of-face grouting program covering 30 miles of double-track main line.

In the spot-grouting work, a machine is assigned to a division and is used to grout the most troublesome soft track or water pockets, which may include side or passing tracks and yard tracks, as well as main line track. The methods employed in spot grouting and in out-of-face grouting are very similar, but the gang organizations and methods of servicing differ, and will be described later.

The Western Lines, where the experimental work was first started, have probably done grouting under a wider variety of conditions than any other portion of the Santa Fe system, while the Eastern Lines have developed the largest organization for main-line grouting.

On the Western Lines

Since May 20, 1942, when the first test was made of a complete grouting unit at Thatcher, Colo., 261,826 track-feet, or approximately 50 miles, of track have been stabilized by grouting on the Western Lines. In this work 361,518 cu. ft., or 13,390 cu. yd. of grout (dry measure) have been pumped into the tracks. The grout applied per track-foot has varied from 0.75 cu. ft. to 3.51 cu. ft., with an average of 1.381 cu. ft. This work has included a wide range of ballast conditions and also both main line and yard tracks, as shown in Table I.

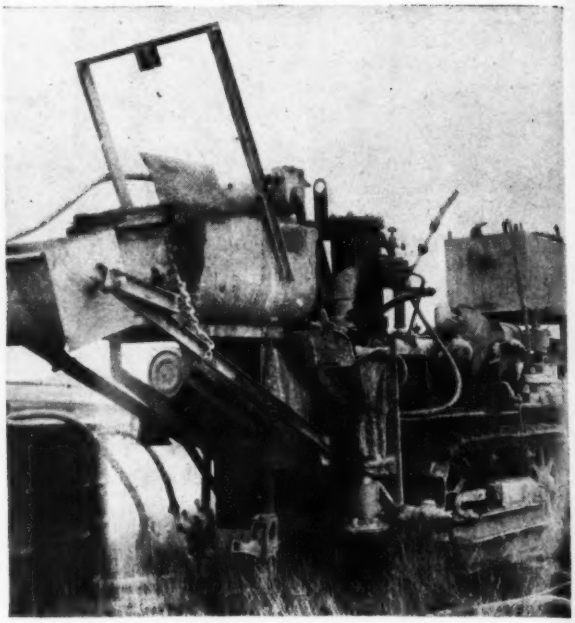
A feature of the work on the Western Lines is the considerable amount of yard track grouting which has been done. Approximately three miles of yard tracks were grouted this year at Wellington, Kan., and this is thought to be the largest mileage of yard tracks ever stabilized at one point by grouting methods. At this location, the subgrade is a gumbo soil covered by cinders, sand, etc., and the tracks stabilized included enginehouse lead tracks and a number of other important service and switching tracks. About ¾-mi. of yard tracks were also grouted at both Pampa, Tex., and Belen, N. M. At Belen, the subgrade is silt, with the water table rising to within four feet from the bottoms of the ties.

The equipment and gang organization for the yard track work are typical of those used for main-line work on the Western Lines. The gang consists of one foreman, one machine operator, one truck driver and 15 to 20 laborers. This gang works 10 hours a day, and is equipped with one Koehring mud jack; a 35-hp. tractor with a compressor, or a tractor and a portable compressor; two modified pneumatic paving breakers with special socket tamping heads for driving bullpoints; two pneumatic spike drivers with similar socket heads for driving grout points; two lines of ¾-in. heavy-duty air hose 250 ft. long for the paving breakers and spike drivers; and two lines of 1¼-in.

heavy-duty air hose 200 ft. long, with "glad hand" couplings, etc., for handling the grout. The gang also has six bullpoints five feet long; 10 to 12 mud points of various lengths (mostly six feet long) and friction plates and claw bars for pulling the bullpoints and mud points; a track jack; two 600-gal. stock tanks for water; a truck with one 600-gal. stock tank; a water pump and two-inch hose; a hand pump for pumping the asphalt emulsion; and other miscellaneous equipment, including a level board.

Everything is self-propelled or arranged so that it can be hauled alongside the track as the work progresses. The water tanks are moved on sleds of oak plank. A large extra-gang motor car and two push cars or trailers are normally used to transport the gang, cement and asphalt to the job. In addition, a small motor car is provided for the machine operator, so he can go to and from the job independently. This is so he can have the equipment ready for operation each morning when the gang arrives, and can remain after the gang leaves in the evening to oil, clean or repair the machines as necessary.

The sand is unloaded in piles, a carload at a time at proper intervals along the track, from 30-cu. yd. air-dump cars handled in local freight service or by switch engines in the yards. The equipment is hauled to the next sand pile when the grouting has progressed to a point mid-way between two sand piles, or when the sand has all been used at one location.



Close-Up of the Original Home-Made, Self-Propelled Track Grouting Machine, Used in Test at Thatcher, Colo.

In the grouting work, the sequence of operations is as follows: After the equipment, accessories, etc., are assembled at a sand pile, the hose lines are laid out and the men start driving and pulling bullpoints. Several gallons of water are then placed in the mixer of the mud jack, the mixer is charged, and the grout is mixed to proper consistency. The grout is then pumped through the grout lines until the water is cleared out and the grout appears at the discharge coupling. At this point grouting is ready to start—a mud point is inserted in a hole, the grout hose is coupled on, and the point is driven down to the proper depth while pumping. If the point is driven below the bottom of the ballast, into subgrade material which cannot be freely penetrated, it is pulled up to a point where the grout is discharged readily. The pumping continues until the grout escapes readily at the surface from an adjacent driven hole or from a nearby crack, and it is felt that no more material can be forced into the hole.

The individual operations of the men in this work vary considerably with the conditions, but they are approximately as follows: Two to four men take care of the water suction line to the mud jack, place sand and cement in the hoist bucket and operate the asphalt pump. Two to four men with the modified pneumatic paving breakers, claw bars, etc., drive and pull bullpoints, keeping a number of holes ahead of the actual grouting. A crew of two to five men insert mud points in holes, drive them to proper depth, couple and uncouple grout hose, pull mud points from the holes after grouting, and move them ahead. Two or more mud points are usually kept ahead of the grouting, ready for quick coupling. The same men do all of the coupling of the grout hose. These men become expert at this, and can uncouple, move ahead and couple up without stopping the grout pumps. With two grouting hose lines, a sep-

Table 1
Location of Track Stabilized by Pressure Grouting on the Western Lines, Since May 20, 1942

Location	Kind of ballast	Track-feet stabilized	Cu. ft. of grout (dry measure)	Av. cu. ft. of grout used per track-ft.
Amity, Colo.—Hadley	Crushed slag and crushed rock	18,437	22,628	1.23
Mayfield, Kan.—Danville	Crushed rock	13,782	17,365	1.16
Timpas, Colo.—Levy, N. M.	Crushed slag and crushed rock	69,701	95,039	1.36
Dermott, Tex.—Hermleigh	Crushed rock	12,926	18,773	1.45
Eppler, Tex.—Dermott	Rock* screenings	12,546	9,444	0.75
Isaacs, Tex.—White Deer	Crushed rock and rock screenings	50,186	65,736	1.31
Taiban, N. M.—Lalande	Crushed rock with screenings and gravel subballast	22,891	49.915	2.18
Lalande, N. M.—Belen	Crushed rock	10,960	26,795	2.45
Pampa, Tex. (Yards)	Crushed rock in main track—unballasted yard tracks	27,207	30,216	1.11
Wellington, Kan. (Yards)	Unballasted—cinders, sand, etc. on gumbo soil	15,470	16,552	1.07
Belen, N. M. (Yards)	Silt sub-grade	4,665	5,975	1.28
Raton Tunnel	Crushed rock, crushed slag	3,055	3,080	1.01
Total		261,826 Trk. ft. or 49.58 Miles	361,518 Cu. ft or 13,389.6 Cu yd.	
Average				1.381

arate crew is needed for each line. One man is usually required to help the mud jack operator, to oil equipment and to haul supplies, etc. Another man is needed occasionally to help the truck driver haul water, and still another man polices the camp, works in the tool car and helps the boarding contractor.

When the track takes a comparatively small amount of grout per track-foot, the progress of the work is greatly increased and an additional bullpoint crew with an additional paving breaker may be needed, especially when using two pumps with two grout lines. Additional men may also be needed on the other jobs specified, bringing the total number of laborers to 20. On main-line tracks, if the traffic is unusually heavy or if visibility is poor, one or two men are assigned as lookouts or flagmen. Protective slow orders are seldom placed on track being grouted.

Both sides of each track are usually grouted. Under certain conditions it may be necessary to insert grout at points only 20 in. apart, or in each crib, while under other conditions, points need be driven at only about 80-in. intervals, or at every fourth crib. Any intermediate spacing of the points may be used, but this can be determined only by experience and by close observation of the work during the grouting. The points are driven a few inches outside of the ends of the ties and at such an angle that the grout discharge takes place approximately below each rail. Bullpoints about five feet long are usually adequate, but mud points with a net length of 10 ft. or more may be needed. This can be determined only by observing the action of the grouting at each particular place. For these reasons, mud points of several lengths are kept on hand.

Spacing and Mixture Important

The success of the grouting operations is dependent largely upon two factors—the consistency of the grout and the proper spacing of the mud points. If a proper mixture is used, penetration can be accomplished. As mentioned previously, some leeway is allowed in the proportion of sand, cement and asphalt. The richer mixtures are needed for more "lubrication," enabling the grout to penetrate smaller voids. The amount of water is also important. Enough water should also be used to insure penetration of the size voids encountered, but excess water is wasteful, because it requires unnecessary time and power to pump the additional volume and also results in a partial waste of the time consumed in hauling, storing and delivering the water to the job. On the other hand, if the grout is too thick, it will not penetrate, but will accumulate in masses or lumps, and the pumping may result in raising the track unevenly. Grout of ideal consistency, properly injected, however, will seldom raise the track sufficiently to be objectionable. The spacing of the mud points is even more a matter of judgment than the consistency of the grout mixture but, as experience is gained, the foreman soon learns to judge what is necessary to secure complete penetration. Upon sound judgment of the mixture and point spacing required, depends to a large extent the degree of improvement made, as well as the cost of the work.

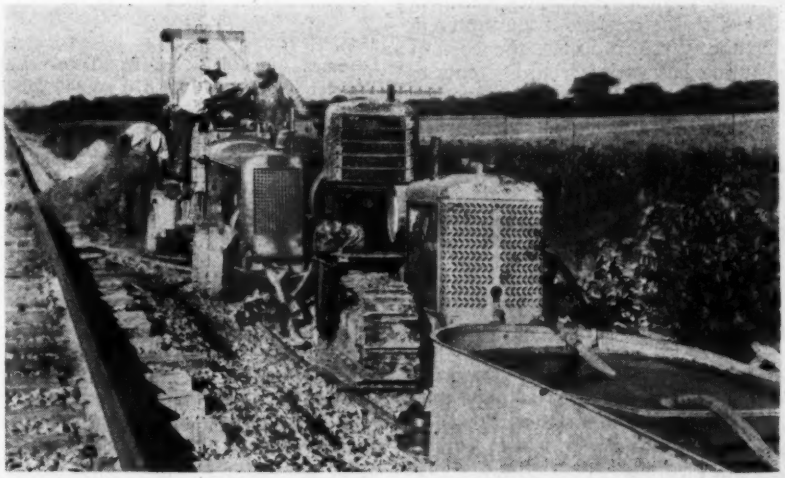
When grouting where the water pockets are full of water, the pressure built up usually breaks a hole out on the subgrade shoulder or at the edge of the soft spot, allowing the water to be forced out as it is displaced by the grout. Attempts have been made to pump the water out of the water pockets in advance, using sand-points and pumps, but the flow has been slow and the same objective is accomplished by displacing the water with grout. This has been proved repeatedly by digging out grouted soft spots to determine the actual penetration secured. Such tests have shown the limits of the grout, sharply outlining the old section of the soft spot, with no wet gumbo below.

Originally, considerable care was taken to avoid getting grout in the ballast above the subgrade. Such care is no longer taken and there is no objection to grouting up to the bottoms of the ties, except that it is a waste of grout. The grout, after it sets, can be easily picked loose for spotting or tie renewals. Inspection pits, dug to control or observe the height of grout, tend to permit its escape and thus prevent as thorough a job as desired. It is sometimes necessary to plug escape points in order to raise the level of the grout in the ballast, or to return after the passage of a little time and inject more grout after the first injection has partially set. When grouting work is done in conjunction with general improvement work, it is preferred to grout the track before surfacing out-of-face.

Grouting on Eastern Lines

Roadbed grouting on the Eastern Lines was started in the spring of 1943 with one machine, although another machine was secured later that year. These lines now have 11 machines, of which 10 have been used during the present year in grouting 30 miles of double-track main line out-of-face between Ottawa Junction, Kan., and Emporia Junction. This out-of-face grouting was done in conjunction with a general improvement program in which the present 110-lb. rail is to be relaid with 131-lb. rail and the tracks resurfaced on 1½-in. chatt ballast after roadbed stabilization. In this locality, the soil conditions are very bad, including a lot of gumbo and "joint" clay. As a result, both tracks had almost continuous water pockets for the entire 30 miles.

The gang organization for the out-of-face grouting is slightly different from that described previously and the servicing is accomplished by work train. The ten machines doing this work were operated by five gangs, with two machines each, and these gangs were usually located about one to two miles apart. Each gang normally consisted of one foreman, one assistant foreman, two machine operators and 26 laborers. By using two



Another Main-Line Track Grouting Outfit with a Mud Jack and a Cletrac Tractor, Carrying a Chicago Pneumatic Compressor

TABLE II
Summary of Out-of-face Grouting—Week Ending Aug. 5, 1944
Eastern Division—Second District—Eastern Lines

Foremen	Men	Track-feet grouted EB	WB	Total	Cost per track-foot Labor	Mat'l	Cu. ft. of grout used	Cu. ft. of grout used per track foot	Total Cost per cu. ft.	Sacks of cement used
Neilson	23	350	437	787	$1.4830	$0.9696	7,770	9.8729	$0.2484	1,295
Hopkins	22	1,730	1,730	3,460	0.3347	0.1789	6,282	1.8156	0.2829	1,047
Tressler	16	1,080	1,080	2,160	0.4069	0.2759	6,042	2.7972	0.2441	1,007
Van Gundy	21	.....	1,312	1,312	0.8186	0.4327	5,748	4.381	0.2856	958
Knight	21	765	745	1,510	0.7151	0.3246	4,938	3.2702	0.3130	823
Total		3,925	5,304	9,229			30,780	4.427		5,130
Average unit cost					$0.581	$0.328			$0.273	

mud jacks with each gang, one tractor could be used alternately to move each set of equipment to the next sand pile. Two portable air-compressors were also used with each gang. The other equipment assigned to each gang was about the same as that already described.

Six-foot mud points were used in all cuts and in the inter-track space. On fills more than six feet high, 10-ft. points were used for grouting under the outside rail. The grout was pumped until it broke out or tended to raise the track, and to avoid distortion of the track, the rail was watched all the time and was checked frequently with a level board. The other details of the grouting process, and the precautions observed, were very similar to the operations explained previously.

The mixture used for most of this work was a straight cement-sand grout, consisting of 6 cu. ft. of sand to one sack of cement (two skip loads), with 24 gal. of water. In the latter stages of this work, all machines were converted to the production of asphalt-cement grout, containing 1 part cement to 12 parts sand.

Costs and Results

As might be expected, the cost of roadbed grouting fluctuates considerably with the conditions encountered. On the Western Lines, the cost of grouting has varied from 30 cents to 54 cents a track-foot, with an average cost of about 48 cents. On the Eastern Lines, the cost has varied from 51 cents to 91 cents per track-foot, with an average of about 77 cents.

Two interesting examples of grouting, showing the track-feet grouted, the volume of grout required and the unit costs, are presented in the accompanying Tables II and III. Each table gives the results of a week's work by the five gangs engaged in out-of-face grouting. Table II shows the results during a week in which most of the gangs were engaged in heavy grouting, requiring a large average amount of grout per track-foot, while Table III shows similar results during a week in which the average volume of grout required per track-foot was relatively light.

While most of the locations grouted have not been in service long enough to provide conclusive evidence of the permanence of the benefits derived from this work, the results to date have been very satisfactory. At Thatcher, one of the oldest sections of grouted track, involving 4.2 miles of single-track passenger main line, speeds of 100 m.p.h. are permitted. At this point, in 1941, the year before grouting, an attempt was made to improve conditions, but in spite of this, it was necessary to keep slow orders in effect on a 1½-mile section 163 days of the year. Two years before grouting, slow orders had been in effect on the same track 262 days of the year. Since grouting was completed, no slow orders have been necessary on this track. Furthermore, a check made of the labor requirements on 3.4 miles of the grouted track, showed that whereas for the year previous to grouting, 7,402 laborer-hours were expended per mile per year, the laborer-hours required for the nine-

TABLE III
Summary of Out-of-face Grouting—Week Ending July 8, 1944
Eastern Division—Second District—Eastern Lines

Foremen	Men	Track-feet grouted EB	WB	Total	Cost per track-foot Labor	Mat'l	Cu. ft. of grout used	Cu. ft. of grout used per track foot	Total Cost per cu. ft.	Sacks of cement used
Tressler	24	1,670	1,670	3,340	$0.3619	$0.1993	6,762	2.0246	$0.2772	1,127
Hopkins	24	1,685	1,685	3,370	0.3493	0.1156	3,906	1.1591	0.3973	651
Van Gundy	24	1,325	1,975	3,300	0.3171	0.1031	3,396	1.0291	0.4084	566
Neilson	24	1,300	1,300	2,600	0.4462	0.1556	4,062	1.5623	0.3852	677
Knight	24	1,695	725	2.420	0.4204	0.2118	5,178	2.1397	0.2955	863
Total		7,675	7,355	15,030			23,304	1.551		3,884
Average unit cost					$0.372	$0.154			$0.339	

teen-month period after the stabilization work was at the rate of only 3,990 per mile per year, a saving of 3,412 laborer-hours. On this basis, the average cost of stabilization in this territory—53 cents per track-foot—was paid back in one year.

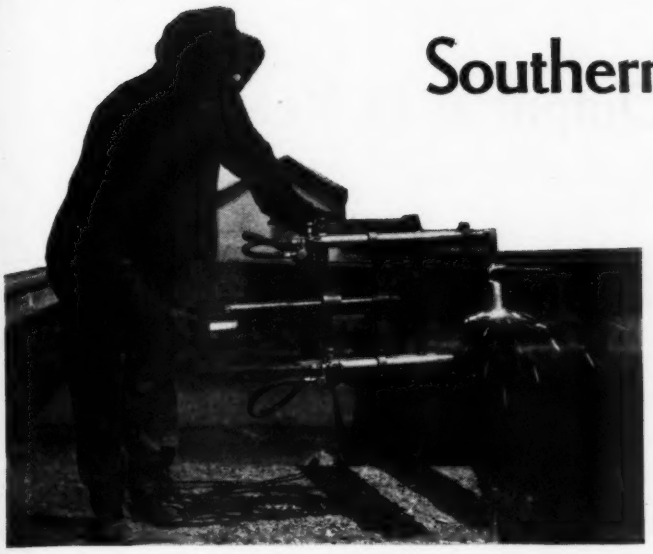
At another point north of Snyder, Tex., on a secondary main line in joint clay country, where almost continuous water pockets have been a source of trouble since the line was constructed in 1912, a similar check was made of one mile of stabilized track. This check showed that before stabilization 2,932 laborer-hours were expended per mile per year and that after stabilization only 936 laborer-hours per mile per year were required. As a result of this saving in labor, the cost of stabilizing this mile, which averaged 40 cents per track-foot, will be returned in two years.

Another example of the effect of grouting is that of 2,300 ft. of track near Maxwell, N. M., which formerly required the attention of track forces every 3 or 4 days. Grouting in this location was begun in the fall of 1942 and was completed in the spring of 1943. After stabilization, a check revealed that this track was not touched for 4 months and 3 days and then required work for only part of 1 day.

On the Eastern Lines, a check was made of a mile of double-track main line on the Eastern division, Second district, which was grouted in May, 1943. For 65 months prior to stabilization, the average maintenance cost was $75.30 a month. For the first five months afterward, the average maintenance cost was $24.22 a month, or a saving of nearly 68 per cent.

All of the roadbed grouting work described has been done under the general direction of G. W. Harris, chief engineer of the Santa Fe system, and under the immediate direction of T. A. Blair, assistant chief engineer of the Santa Fe system. Mr. Blair was largely responsible for initiating the research and development, which was carried out principally by John R. Rushmer, roadway engineer, Amarillo, Tex. The supervision of the grouting work on the Eastern, Western, Gulf and Coast lines has been under the general direction of the chief engineers of those lines. Valuable assistance was given the Santa Fe by the Texas Company in research leading to the development of a successful asphalt-cement grout, and also by the Koehring Company, which helped by adapting its mud jacks for track grouting in accordance with requirements developed by the Santa Fe.

Southern Crops Rails With Special Torch Assembly



Showing the Oxy-Acetylene Rail-Cropping Device in Operation

A RAIL-CROPPING plant is now in operation on the Southern at Columbia S. C., of which the outstanding feature is a special arrangement of oxy-acetylene torches for cutting the rails. This device consists essentially of two torches mounted in a frame that can be clamped to the rail, and which incorporates a hand-operated screw feed for moving the torches across the rail during the cutting operation. Experience has shown that two of these assemblies are capable of cutting the ends from a rail in two minutes, although some time is occasionally lost in cleaning the tips.

In recent years the volume of traffic handled over the Columbia division of the Southern has shown a sharp increase, and, since most of the rail on this division was of the 85-lb. section, it became essential to replace it with heavier rail. The prospect was that a considerable amount of relay rail of the desired weight, consisting largely of 100-lb. rail, would be released from main-line divisions, and that, after cropping and redrilling, this rail would be adequate for use on the Columbia division, which consists largely of secondary main lines and branch lines. For the purpose of getting this rail into shape for relaying, it was decided to install a cropping plant at Columbia, this point being chosen because of its central location and because in other respects also, including the facilities available for handling the rail, it was considered most suitable for the work.

One of the problems encountered in establishing the cropping plant was to choose an economical and effective method of cutting the rails. This was solved, as already indicated, by the development of a portable oxy-acetylene cutting device that has proved highly successful in operation. The basis of the device is two cutting torches with 90-deg. heads, which are mounted on a frame in such a manner that the cutting tips are opposed to each other. The torches, which are free to move in guides mounted on the frame, are fastened to a cross-head which is actuated by a hand-operated screw feed. The assembly is provided with a clamping attachment, by means of which it can be fastened rigidly to the rail at any desired point.

Details of Torch Operation

When the device has been clamped to a rail in position for cutting it, one of the torches is above and the other is below the rail, with the tips pointing directly toward each other. To crop the rail, a cut downward through the head is made first with the upper torch, after which a cut upward through the base is made in the opposite direction with the lower torch. The cutting machine is then detached and transferred to the next rail, a process that requires a negligible amount of time. The newly-cut rail ends are then ground with a flexible-shaft grinder to remove all burned metal, although the experience has been that very little grinding is necessary. As part of the grinding operation, the running surface of the rail is chamfered for 1/16 in. back from the rail end.

Before the machine described above was adopted for use at the rail cropping plant, laboratory tests were made of specimens cut with an oxy-acetylene torch, as a result of which it was decided that, after grinding, rails cut in this manner suffer no ill effects. No failures have been encountered in any of the rail cropped.

Cropping Procedure

The rail cropped at Columbia is largely of 100-lb. section, 33 ft. in length, and the practice is to cut 12 in. from each end. The cropping operation is performed on a set of skids placed between two parallel tracks, 200 ft. apart, this distance being ample to permit the storage of several carloads of rail on the skids, if this should become necessary. The rail is transferred from low-side gondolas to the skids by a locomotive crane. At their receiving end, the skids are sloped somewhat to permit the rails to be moved readily to the section where the cropping and other operations are performed. The shifting work is done by two laborers who also remove the bond wires from the rail and clean the rail ends. Using two of the cutting assemblies, the rails are then cropped by welders, after which

General View of a Portion of the Rail-Cropping Plant at Columbia

the rail ends are ground as necessary, using a Mall Model GC-3 portable flexible-shaft grinder.

By means of a templet, the rails are then marked for drilling and are moved along on the skids to the point where this operation is performed.

The drilling is done by two Model MW Everett single-chuck gasoline-engine driven rail drills which are mounted in such a manner as to permit them to be moved in and out as required by rails of different lengths, without disturbing the production line. The drilling work is carried out simultaneously at both ends of the rails, and about two minutes are required to drill each rail. Special tanks have been mounted on each drill to allow a flow of soluble oil solution to the drill bits during the drilling operation. This solution is strained and collected in tanks below the drills for re-use. A Nordberg Model AZ gasoline-engine-driven bit grinder is used to sharpen the drill bits, which grinder has a special attachment for centering the bits as required.

Ends Are Flame-Hardened

After the rails have been drilled, they are moved along on the skids into the loading position, where the ends are flame-hardened. This process, performed with oxy-acetylene torches, consists of heating the head at the rail end to a temperature of 1,500 deg. F., after which it is quenched to 300 deg. and then reheated to 600 deg. It is found that two welders with two helpers can end-harden as many as 20 rails per hour. Two pyrometers are used for checking the temperature of the rails during the flame-hardening process. When the rails have been flame-hardened, they are loaded for shipment by means of a stationary hand-operated pillar crane.

A force of twenty men is employed at the rail-cropping plant, including a foreman, a crane operator, three welders, three machine operators, three welder helpers, and nine laborers. As many as 160 rails have been handled through the plant in an 8-hr. day. The average daily output is 130 rails—that is, this number of rails, on the average, are unloaded, cropped, and drilled and reloaded for shipment. Because of the uncertain deliveries of new rail for replacing the rail to be cropped, it has not been possible to keep the cropping plant in continuous operation. If this were possible, it is felt that the output would be considerably larger than has been realized under present conditions. Even under these conditions, the results obtained at the new plant have been so gratifying that it is now proposed to install a similar layout at Pomona, N. C., and to include a rail-straightening machine at this new installation.

The arrangement of cutting torches that is in use at the Columbia plant was devised by W. O. Couch, supervisor in the Applied Engineering department of Air Reduction Company.

Rail Output at 14-Year High

THE production of rails in the United States in 1943 totaled 2,126,996 net tons, a gain of 30,837 tons as compared with 1942 and a new high since 1929, according to figures published in the annual statistical report of the American Iron and Steel Institute for 1943. Furthermore, starting in 1938 when the output was 697,642 tons, 1943 was the fifth consecutive year in which rail production has registered a gain over the preceding year. Nevertheless, it is pertinent to mention that the output of rails is still far below that during certain years in the Twenties, when, for instance, in 1926 it was 3,603,767 net tons.

In the accompanying table, which shows the output of rails in 1943 and previous years back to 1927, the production for each year is broken down into four weight groupings. In previous years six weight groupings were shown, but because of the reduced number of rail sections being rolled, coupled with the fact that the total production of rail is now largely concentrated in a relatively few sections, the logical move was to consolidate the weight groups into a smaller number of classifications.

Production of Rails by Weight Per Yard—Net Tons

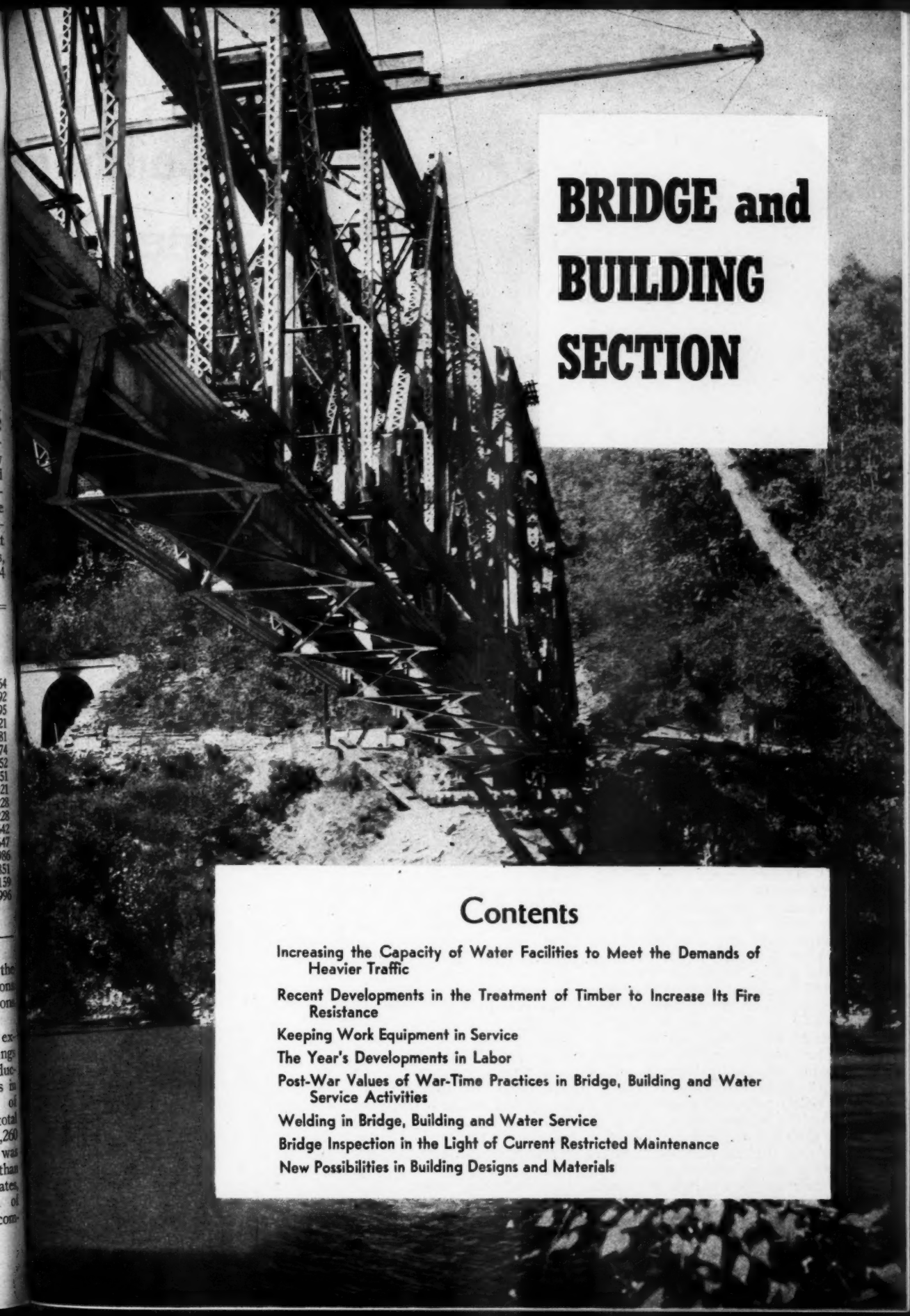
Years	60 lb. or less	Over 60 and less than 100 lb.	100 and less than 120 lb.	120 lb. and over	Total
1927	*181,256	†798,226	1,472,155	691,627	3,143,264
1928	*150,301	†662,053	1,348,199	804,639	2,965,192
1929	*158,326	†574,080	1,381,631	934,758	3,048,795
1930	*107,101	†391,079	935,756	664,085	2,098,021
1931	* 56,100	†166,793	555,242	518,546	1,296,681
1932	* 18,654	† 47,374	240,902	143,944	450,874
1933	55,010	63,153	172,488	175,601	466,252
1934	78,495	101,640	550,639	401,677	1,131,451
1935	63,982	112,431	381,696	238,812	796,921
1936	107,644	135,585	684,910	438,099	1,366,228
1937	113,889	218,374	815,280	471,685	1,619,228
1938	50,375	85,177	371,534	190,556	697,642
1939	92,994	83,611	620,992	515,050	1,312,647
1940	140,443	339,672	688,109	510,762	1,678,986
1941	172,264	323,968	820,695	610,924	1,927,851
1942	124,938	438,562	924,851	607,808	2,096,159
1943	164,096	364,715	847,839	750,346	2,126,996

* Under 50 lb. per yd.
† 50 and less than 100 lb. per yd.

From a study of the table it will be seen that, although the total production of rail showed an increase as compared with 1942, the output of the two intermediate weight groups declined, these losses being more than offset by increases in the lightest and heaviest classification. Specifically, the weight group including sections over 60 lb. and less than 100 lb. showed a decrease of 73,847 tons, or nearly 17 per cent, while the output of rails weighing 100 lb. and less than 120 lb. declined 77,012 tons, or 8.3 per cent. These decreases were overcome almost entirely by an increase of 142,538 tons, or 23.5 per cent, in the production of rails weighing 120 lb. and over. This was augmented by an increase of 39,158 tons, or 31.4 per cent, in the production of rails weighing 60 lb. or less.

Of the total tonnage of rails produced in 1943, 2,047,075 tons, or 96.2 per cent, were rolled from open-hearth steel. Although the quantity of rails rolled from Bessemer and electric steels (23,747 tons) constituted only a small fraction of the total, the tonnage in this category reflected the tendency to increase that has been in evidence for several years, comparing with a output of 21,334 tons in 1942. Also included in the total output for 1943 were 49,440 tons rolled from old rails, and 19,179 tons of girder and high tee rails.

Contrary to what might be expected, the production of fastenings in 1943 underwent a moderate reduction, declining from 718,258 tons in 1942 to 665,956 tons, a drop of 52,302 tons, or 7.3 per cent. The total output of fastenings included 167,260 tons of angle slice bars, which was 9,645 tons, or 5.5 per cent, less than 1942, and 464,365 tons of tie plates, which represented a decrease of 38,172 tons, or 7.6 per cent, as compared with the previous year.



BRIDGE and BUILDING SECTION

Contents

Increasing the Capacity of Water Facilities to Meet the Demands of Heavier Traffic

Recent Developments in the Treatment of Timber to Increase Its Fire Resistance

Keeping Work Equipment in Service

The Year's Developments in Labor

Post-War Values of War-Time Practices in Bridge, Building and Water Service Activities

Welding in Bridge, Building and Water Service

Bridge Inspection in the Light of Current Restricted Maintenance

New Possibilities in Building Designs and Materials

Bridge and Building One-Day

Much Essential Building Work Must Be Done During War-Time

GIVING up its regular three-day annual meeting in the interest of the campaign of the Office of Defense Transportation to minimize train travel, the American Railway Bridge and Building Association held a one-day executive meeting at the Hotel Stevens, Chicago, on October 18, to consider and pass upon the work of its technical committees during the year, to take up much other essential current work, and to plan for the activities of the association in the year ahead. It was the second consecutive year that the association found it desirable, if not essential, in the interest of the war effort, to curtail its annual meeting, last year having reduced its regular three-day meeting to two days in what it termed a War-Time Conference.

The abandonment of its annual meeting this year has put an added strain on the association, but, carrying on a tradition of more than fifty years, the officers and directors of the association adopted an aggressive plan for the year ahead, envisioning, among other things, a drive for new members which it expects will exceed in effort and success anything in the past. If the spirit which prevailed at the meeting on October 18 is any criterion, these plans are certain to succeed, because, in intensity, enthusiasm and meticulous attention to details, the meeting was not surpassed by any meeting in recent years.

Presided over by J. L. Varker, bridge and building supervisor, Delaware & Hudson, Carbondale, Pa., the meeting get under way well ahead of usual schedule, with more than 60 in attendance, including 13 officers and directors, the chairmen of most of the technical committees, and other members and guests largely from the Chicago area. The principal features of the program included the presentation and discussion of the eight technical reports prepared by committees during the year, which was followed by a roundtable discussion of timely subjects which, it appeared, would extend well into the evening if the group had not been dispossessed of their meeting room by a prior commitment of the hotel. However, determined to complete their work, the meeting was adjourned to an adjacent ballroom, where, despite the noise and confusion of preparing this room for another group, it was continued for more than an hour.

The only deviations from this intensive consideration of technical matters were the opening address by the President, a short session of tribute to the late Elmer T. Howson, a past-president of the association and, until his death on September 1, editor of *Railway Engineering and Maintenance*, and the closing business session, held to determine ways and means of increasing membership in the association. At this session it was decided to urge greater support of the association among the higher engineering and maintenance officers of the railroads, and to make a concerted drive for members among bridge, building and water service men through committees on each road.

President's Address

In his opening adress, after reviewing the activities of the association during the year and urging continued support of its work in the interest of adequate war-time rail transportation, President Varker said in part as follows:

"In the year ahead, in the face of a continuing shortage of labor and a scarcity of materials and equipment, we will, no doubt, continue to be faced with many difficult situations. However, bridge and building men, with the aid of their friends in the bridge and building supply in-

Officers Hold Executive Meeting

Business session, replacing cancelled annual meeting, gives consideration to 14 timely subjects and sets up drive for new members

J. L. Varker
Chairman

dustry, will continue to solve their problems as they are doing today.

"It is a challenge—our association must carry on aggressively and find a solution of these problems. Never was there greater need for our association than today—never have we had a greater opportunity for service to the railroads and to our country. The things we have accomplished in the past are merely prologue to the g r e a t e r responsibilities that lie ahead. The railways—the country—are looking to us to play our part in a continuation of the war-time railway service that is amazing the nation. We cannot fail.

"In looking beyond the clouds of the present war years, we face problems and opportunities beyond anything in the past—problems in building back into our bridges, buildings and other structures the toll that is being exacted from them during the war years, to modernize these structures in keeping with the post-war developments in passenger and freight service, which will demand higher speeds, more intensive train schedules, and greater comfort—all, with increased safety and economy. These are our obligations—these are our opportunities."

Eulogize Past-President Howson

In the pause in its active day to honor Elmer T. Howson, past-president of the association, and until his death on September 1, editor of *Railway Engineering and Maintenance*, Armstrong Chinn, general manager of the Alton, a long-time friend of Mr. Howson's, and himself a past-president of the association, eulogized Mr. Howson for his character, his ability, his untiring energy and his contribution to the work of the Bridge and Building Association, and then singled out for special attention the stimulation he offered so freely to young men. He said in part as follows:

"You have, no doubt, already heard and read about his tireless energy, his almost insatiable desire to be doing something constructive all of the time. How, almost single-handed, he kept this association and others like it alive during the depression years, while at the same time carrying on his many other exacting duties. How, with never-ending zeal, he fought for the interests of the railroads and for the men who run them. But, in addition, anyone who was around Elmer very long soon learned of his love for perfection. One could not be around him and do careless or indifferent work, because he would usually find ways of encouraging you to better and more earnest effort. He made you want to aim higher and gave you the desire and confidence to do so. Many men, particularly in the railway field, are holding better and more responsible positions today because of the inspiration derived from their contacts with Elmer Howson.

"He also seemed to feel a responsibility for getting young men started right in life. He was always recommending some young man for committee work, or for the chairmanship of some committee in one or the other of our railway associations, so as to give the young man an opportunity to develop and bring himself to the front. These characteristics of helping to bring out the best in others, and in helping young men off to a successful start were, to my mind, two of Elmer's finest characteristics. If helping one's fellow men on earth brings a reward in the hereafter, as I am sure it does, Elmer will be well and favorably remembered by the Giver of all good and perfect gifts."

Following Mr. Chinn, Clarence R. Knowles, superintendent of water service, retired, Illinois Central, a past-president of the association, and a co-worker with Mr. Howson in association work since 1912, paid tribute to him as a man of boundless energy and devotion, especially in the interest of various railway organizations. He said in part as follows:

"Although he took an active part in carrying on the work of the many

Bridge and Building Association

Officers 1943-44

J. L. Varker, president, supv. b. & b., D. & H., Carbondale, Pa.

R. E. Caudle, first vice-president, prin. asst. engr., M. P. Lines, Houston, Tex.

N. D. Howard, second vice-president, editor, *Railway Engineering and Maintenance*, Chicago.

F. G. Campbell, third vice-president, asst. ch. engr., E. J. & E., Joliet, Ill.

J. S. Hancock, fourth vice-president, br. engr., D. T. & I., Dearborn, Mich.

Elinor V. Heffern, secretary, Chicago.

C. R. Knowles, treasurer, supt, w. s., I. C. (retired), Chicago.

F. E. Weise, treasurer emeritus, ch. clerk, engineering dept., C. M. St. P. & P. (retired), Chicago.

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E. H. Barnhart, div. engr., B. & O., Garrett, Ind.

A. B. Chapman, br. engr., C. M. St. P. & P., Chicago.

L. E. Peyser, prin. asst, arch., S. P., San Francicso, Cal.

G. S. Crites, ex officio, div. engr., B. & O., Baltimore, Md.

groups with which he was affiliated, his interest in the work and activities of the Bridge and Building Association was second to none. All through the difficulties of the depression years, and the following war years, he worked constantly to sustain the interest of the officers and members of this association, and it was due very largely to his untiring efforts that this association survived its ordeals. In fact, if it had not been for the efforts of Elmer Howson, I doubt very much whether we would be meeting here today. As individual members, and as an association, we owe him a debt of gratitude that can never be paid."

Fourteen Subjects Considered

The technical committee reports submitted to the meeting, all of which are presented in full in the following pages, dealt with the following eight subjects: Increasing the Capacity of Water Facilities to Meet the Demands of Heavier Traffic; Bridge Inspection in the Light of Current Restricted Maintenance; Post-War Values of War-Time Practices in Bridge, Building and Water Service Activities; New Possibilities in Bridge Designs and Materials; Recent Developments in the Treatment of Timber to Increase Its Fire Resistance; Keeping Work Equipment in Service; The Year's Developments in Labor; and Welding in Bridge, Building and Water Service.

In the roundtable discussion, which was conducted by A. E. Bechtelheimer, bridge engineer of the Chicago & North Western, and a past-president of the association, consideration was given to the following subjects: Failures of Culvert Pipe; Raising Bridges in Ballasting Programs; The Procedure To Be Followed in Replacing Failed Bridge Seat Stone; The Function of Hook Bolts on Timber Decks of Steel Spans; Pointing Stone Masonry; and Repairing Masonry by Grouting.

Late in the session, upon the suggestion of a twelve-man Subjects committee appointed earlier in the year, the Executive committee approved the following eight subjects for committee study during the ensuing year: Economical Methods For the Maintenance of Impounding Reservoirs; Restoring Old Masonry By Grouting, Including Surface Treatment Where Necessary; New Developments in Interior Painting; The Maintenance of Wood Bridges and Trestles; The Influence of Maintenance Practices On the Development of Modern Enginehouses; The Use of Highway Trucks in Bridge and Building Work; The Merits of Various Types of Piles; and The Elimination of Fire Hazards and the Maintenance of Fire Protective Equipment.

In the absence of a regular meeting, there was no election of officers, so that the present officers and directors will continue in office for the ensuing year. The only exception in this regard was the election of a new secretary in the person of Miss Elise LaChance, with new headquarters in the Manhattan Building, 431 S. Dearborn St., Chicago, effective November 15. Likewise, there was no exhibit of the Bridge and Building Supply Men's Association, a feature which has formed a valuable supplement to the annual meetings of the association in the past.

Increasing the Capacity of Water Facilities to Meet Demands of Heavier Traffic

Report of Committee

Guy E. Martin
Chairman

THE large increase in tonnage and train-miles on the railways since December, 1941, has created a serious problem in maintaining an adequate supply of water for locomotives at many terminals and other key water stations. This increase in traffic, combined with larger locomotive tenders, has further increased the demand for water at stops, and in some cases has called for a change in the location of stops and water stations. Many terminals handle 30 to 40 per cent more locomotives now than were handled prior to 1941, and tender capacities have increased as much as 100 per cent or auxiliary tenders have been attached. These conditions have made many water plants or certain portions of them inadequate.

Stations Using City Water

At some locations where water is secured from a city water supply, it has been found that meters and supply pipes from the city mains were too small for adequate flow. In such cases, larger or additional meters and supply pipes have been installed by the railways. In some instances, a sufficient flow has been obtained without installing larger pipes by cleaning existing lines with mechanical scrapers or with acid, thereby removing incrustations and other obstructions. In other cases, the city water departments have increased the size of feeder mains or increased the line pressure to meet the requirements of the railways.

In one case reported, the city filter plant proved to be the bottleneck, as this part of the plant was inadequate to filter the municipal requirements, plus the unusual demands of the railways and other industries. At this point, two railways using 50 per cent of the city pumpage agreed to accept unfiltered surface water at the same rates paid formerly for the filtered water. The city, in turn, installed large capacity pumps to bypass the unfiltered water required by the railways, at sufficient pressure to meet their requirements.

Stations Supplied by Wells

There has been a general lowering of the ground water levels in many parts of the country, which has caused decreased production

from many wells. Some railways have found it necessary to install additional wells or to recondition existing wells. To increase production the required amount, acid, dry ice and other means have been used to break up screen incrustations and to remove calcium and other obstructions from the water-bearing formation.

One case is reported where the water production from the principal well at an important terminal decreased 50 per cent in a short period of time. This terminal handles approximately 65 main-line locomotives per day, with tenders and trailer tenders of 23,000 gal. capacity. Since the well failure caused serious delays, another tubular-type well was installed on a rush-order contract. When this well was in service, attempts were made to recondition the old well, of gravel wall construction, but it was beyond repair and a new well will be installed to replace it. At this particular terminal the yield from the water-bearing formation is below the average usually found and an auxiliary supply is not available. Conditions similar to this require quick well maintenance and construction to keep the water supply up to requirements.

Stations Supplied by Reservoirs

The construction of reservoirs by railways now receives careful study by topographical and water service engineers. The watershed area is surveyed and the run-off computed after securing rainfall data for an adequate number of years from the nearest government weather station. The capacity of the reservoir is fixed so that the lightest run-off indicated will provide sufficient water storage for the longest drought period expected, after all uses and losses of water are deducted.

Many of the older reservoirs are filling with silt and vegetation, which reduces their capacity seriously, while the present use of water is greater than originally expected. In addition, the drought periods, in some cases, have been of unusual length. This has resulted in a shortage of water at these locations. Under such conditions, consideration should be given to removing the accumulation of silt in the reservoir, or to increasing the height of the dam and spillway.

One railway recently cleaned a reservoir by using a portable hydraulic dredge, but some difficulty was experienced on account of insufficient water to permit continuous pumping. Such equipment can be justified only when the amount of silt to be removed is large and is of a character to permit pumping. Another road is planning to clean a reservoir by using a slack cableway dragline excavator. Underwater excavation can be done economically and satisfactorily with this type of equipment if handled by an experienced rigger and operator. At another location, plans are being made to remove about 100,000 cu. yd. of silt with a power drag scraper. At this location, the area to be cleaned can be dewatered sufficiently to permit the use of a scraper instead of a dragline bucket, thus requiring a smaller tower and less anchors for the operation. In some cases conventional excavating equipment can be used to advantage.

In cases where the reservoir storage is insufficient, an auxiliary reservoir should be considered if a favorable site is available. Where storage and run-off are inadequate, and a creek or ditch with a seasonal flow is near, a large capacity pump may be installed to pump into the reservoir during periods of stream flow. One railway has several of these installations and maintains sufficient water by combining the natural storage with the water pumped in from the small streams during periods of flow.

Additional Roadside Tanks

Some railways have built an additional roadside tank at stations subject to increased peak demands, as the storage which was adequate prior to 1941 has been found inadequate to meet present demands. "Fleeted" trains, stopping for water at short intervals, sometimes deplete the water storage to the extent that the later trains of the fleet are delayed while water is being pumped into the tank. One railway had two locations where an additional 100,000-gal. tank was rushed to completion during the winter months to overcome this condition. At one of the locations more storage and also more head were required to speed up the delivery of water, and it was decided to install the new tank on a tower 10 ft. higher than the old tank foundation. In order that the lower tank could be filled without overflowing, a 10-in. combined inlet and outlet float valve was installed on the water column main and the tank was allowed to fill through this valve, which also permitted water to flow to the columns. All water was pumped into the higher tank after it was treated by chemical proportioning equipment, and the arrangement did not require dual equipment.

B. & B. SECTION

The larger tenders in use require an increased water flow if they are to be filled without excessive delay, and this flow has been secured from tanks in some cases by giving the tank valve more opening. At the same time, the diameter of tank sway spouts has been increased from 10 in. and 12 in. at the outlet elbow, to 14 in., and the curvature of the elbow has been reduced. This change in spout design has been made to permit a faster flow of water from the tank valve without the bottleneck effect which occurred in the smaller spout. With a large tank valve opening, the smaller spouts were lifted up from the tender manhole by the water pressure, and the fireman could not operate them satisfactorily. The larger spouts, without taper at the outlet end, permit large flows without this difficulty.

Water Columns and Mains

Many railways have had trouble in securing adequate flow from existing water columns for filling the large capacity tenders without unusual delays. Where cases of slow flow exist in water columns, first and immediate consideration should be given to cleaning the pipe, valves and bends of incrustations or other obstructions, and the water column valve should be adjusted and cleaned to provide a maximum rate of flow. If careful cleaning and maintenance do not give an adequate flow, additional construction should be considered. Accessories should be provided for handling the water column spout conveniently and safely.

At many water stations a flow of 4500 gal. per min. is desirable, but often 2,500 to 3,000 gal. per min. was all that the original installation would furnish. In cases of this kind, roadside tanks have been raised, larger water columns have been installed and water column mains have been cleaned of incrustation or other obstructions by acid or by mechanical scrapers. When these means prove inadequate, an additional pipe from the tank may be installed and connected into the original supply pipe at a point near the water column. This arrangement provides a "loop" system of supply and permits continued use of the existing pipe to better advantage than to remove and salvage it.

Where the water column main between the roadside tank and the

water columns is unusually long, with a resulting friction loss, an additional small tank may be erected near the water columns and supplied from the remote tank during off-peak periods. This will provide adequate flow and is usually more economical than installing a larger pipe from the original tank. In a few cases, railways have used small buried tanks and have pumped the water into locomotive tenders by large capacity pumps, which operate only when filling the tenders. This arrangement is used where building space is limited or where other reasons prevent the erection of an elevated tank.

Track Pans

The number of railways using track pans for supplying water to locomotives while the trains are in motion is relatively small, but these railways operate in territories of unusual traffic density so that improvements to "speed up" this type of water delivery are now urgent.

One railway has changed its standard water scoop to reduce the area of the mouth of the scoop and to permit it to extend into the water at a relatively flat angle, thereby reducing the wave action in the trough and the loss of water. The method of raising and lowering the scoop, which is done by air, was also changed to permit quicker release of the exhaust, decreasing the time required for lowering and raising the scoop. These changes permit a greater amount of water to be taken at a higher rate of speed, with a reduction of spillage, over the operation of the former scoop. The increased speed in spout operation also permits water to be taken for a greater distance with the same margin of safety. The increased amount of water taken in the shorter period of time also necessitated the changing of air vents in the tenders to prevent a back pressure of compressed air.

Treating Plants

In addition to demands for a greater quantity of water, there has been a demand for better quality in order to reduce engine trouble due to foaming and scaling. Many treating plants designed for an hourly rate of water softening which was considered adequate when the plant was constructed, are now found to be inadequate due to the greatly increased requirements. Where the output of treated water becomes inadequate, a careful check should be made of the plant to determine where the bottleneck exists. Some times this occurs in a part of the plant rather than in the whole unit. The maintenance should be checked, pipe lines and filters cleaned of scale and sludge, and new construction planned if conditions cannot be corrected otherwise. Sometimes the reaction tanks, filters, rehandling pumps and pipes are found to be too small. If the plant is manually operated, relief is often effected by installing automatic operation or by increasing the hours of operation with additional shifts of operators.

Modern Design

If the plant is working up to the time limit, as well as the softening limit, a more modern design of plant should be considered to hasten the chemical reactions and to speed up the output of treated water. Water softening equipment is now on the market that will permit producing a treated water of equal or better quality than conventional plants which require treating tanks much larger than are necessary with the newer equipment. This is accomplished largely by continuous agitation of the lime sludge, coupled with specially designed equipment. Two or more roads now have such installations. Another is planning on replacing four treating tanks at two plants because of their poor condition, and will replace them with two having about one-fourth the original capacities. Improvements in older plants have been effected by sludge recirculation and intermittent agitation with air.

Automatic electric operation of treating plants is often advisable where the treated water storage is limited or where the hourly rate of treatment is not adequate to maintain sufficient storage without extra shifts of operation.

Automatic Pumping Equipment

Many water stations have reciprocating steam pumps for surface supplies and steam-head, single-acting pumps for well supplies. This type of equipment requires an excessive use of man-power if additional shifts of men are required to maintain the water storage. At such points, automatically-controlled electric pumps should be considered, as this type of control provides for starting the pumps at any time when the stage of water in the roadside tank recedes to a limited point below full capacity. It also affords maximum storage capacity at all times and permits this maximum to be restored between locomotive water stops. Automatic control is not only more economical than manual control, but is also a measure that is particularly adaptable to water stations subject to over-demand and peak-demands, and should be considered as a means for obtaining full capacity.

Conclusion

(1)—Increased locomotive movements and larger tenders have placed excessive demands on many water stations, especially terminal and key stations.

(2)—Water stations with a city water supply should be checked to determine that meters and supply lines are of sufficient size and are clear of incrustation and other obstructions.

(3)—Wells should be checked as to production and inspected for screen cleaning and good maintenance. At terminal stations depending upon wells, repairs or the installation of additional wells often become emergency jobs, as this source of supply is subject to sudden failure, which requires prompt repair methods or a change in the source of supply.

(4)—Surface reservoirs may require cleaning of silt and vegetation to restore their original capacity. In some cases auxiliary reservoirs may be constructed if a favorable site exists. Pumping from nearby creeks or ditches to the reservoir during seasonal creek flow is also useful in maintaining an adequate reservoir supply.

(5)—Additional roadside tanks are sometimes required at locations where existing tanks are inadequate to provide water for the peak demands of "fleeted" trains.

(6)—Water columns and mains often require cleaning or additional construction to supply a rate flow sufficient to avoid excessive delays in filling large locomotive tenders.

(7)—Some treating plants have become inadequate to supply the increased water demand. In some cases, inspection may show that certain parts of the plant, rather than the plant as a whole, require reconditioning. Where treating tanks are too small, or have to be rebuilt for other reasons, consideration should be given to recent improvements in the design of treating plant equipment.

(8)—Automatic pumping equipment is particularly advisable at stations subject to heavy demand, as such equipment maintains the roadside tank storage at full capacity between locomotive water stops. It is also generally more economical than manual control or the operation of

stations with reciprocating steam pumps.

Committee—Guy E. Martin (chairman) supt. w. s., I. C., Chicago; K. J. Weir, (vice-chairman), supvr. w. s., C. M. St. P. & P., Chicago; R. C. Bardwell, supt. w. s., C. & O., Richmond, Va.; F. M. Ginter, fore. w. s., Alton, Bloomington, Vt., Stafford Springs, Conn.; E. E. R. Tratman, civil engr., Wheaton, Ill.; and M. P. Walden, asst. supvr. b. & b., L. & N., Evansville, Ind.

Ill.; J. P. Hanley, w. s. insp., I. C., Chicago; F. H. Masters, ch. engr., E. J. & E., Joliet, Ill.; A. C. Sachs, gen. fore. w. s., C. N. R., London, Ont.; C. O. Sathre, asst. supvr. b. & b., C. & N. W., W. Chicago; T. J. Sheehy, supvr. w. s., D. & H., Plattsburg, N. Y.; A. P. Smith, fuel & water supvr., M. P., San Antonio, Tex.; W. A. Stewart, ret. asst. supvr. b. & b., C.

B. & B. SECTION

Recent Developments in the Treatment of Timber to Increase Its Fire Resistance

Report of Committee

J. F. Seiler
Chairman

ON every railroad there are many buildings and other structures, and their equipment, that are so important to the daily operation of the railroad, that if damaged or destroyed by fire, they would have a serious effect on the ability of the road to render transportation service. They are listed and commented on more or less in the order of their importance, as follows:

(a) *Enginehouses*—These structures, whether constructed of wood, brick, or concrete, include sufficient combustible material to constitute a decided hazard. Their destruction or injury by fire would be of serious consequence to normal operation.

Usually, in conection with enginehouses of any size, powerhouses, oil storehouses and machine shops are common, and should be constructed of fire-retardant materials.

(b) *Coaling trestles and sand drying facilities*—On some railroads, some coaling and sanding facilities are constructed of wood, and some of these structures at principal terminals consist of long inclined trestles with coal and sand hoppers. Structures of this type accumulate a large amount of coal dust, which, together with the sand drying stoves, create a great fire hazard. The timber making up such structures should certainly have fire-retardant qualities, as the operation of a main terminal would be impaired seriously if they were destroyed by fire.

(c) *Train control, signal and electrical buildings*—During the last four or five years the railroads have spent enormous sums of money for the installation of centralized traffic control systems, and in some cases the main operating plants or the headquarters for the dispatchers are in old buildings, which, in most cases, are vulnerable to fire. In some cases the only heating facilities are coal stoves, which can create a serious fire hazard if they are not given adequate attention. In many cases it is not the protection of the building itself against fire that is most important, but the materials and equipment housed within them.

(d) *Car equipment facilities*—Under this heading should be grouped all of the buildings, with their machinery, required to build and maintain the rolling stock of a railroad. These include coach shops, car repair shops, painting, upholstering and carpenter shops; lumber storage sheds, etc. Under present-day conditions, the possible loss of equipment and the unusual delays encountered in making repairs certainly warrants the additional cost of providing fire-retardant materials in these structures.

(e) *Storehouses, freight houses, etc.*—While buildings of this type are usually of brick exterior construction, the floors and roofs of some of them are of wood framing. This constitutes a fire hazard, which is usually aggravated by the character of the materials stored in these buildings. In existing structures of this type, sections partitioned for the storage of inflammable materials can be divided off with fire-retardant materials.

(f) *Outlying buildings,* including section tool houses, small yard offices, switchman's buildings, passenger stations or shelters, ice houses, pump houses, water tank structures, watchman's buildings—This group of buildings could be made to include all of the minor buildings necessary for the operation of a railroad. While the loss of any one or more of these buildings would not affect the operation of a railroad, some branch of the service would be handicapped until a replacement could be made.

These outlying buildings may not present a fire hazard in themselves, but there is usually the danger of grass fires which, if not controlled, might destroy them. In the event of damage to any of these structures by fire, it would at least require extra work on the part of the maintenance forces to rebuild them.

(g) *Bridge ties*—These are included because of the definite tendency on some roads toward the salt or fire-retardant treatment of bridge ties to minimize the possibility of fires in open-deck bridge structures, particularly those, the replacement of which would be difficult, expensive and time-consuming. The combination of decay and fire-resistant treatment would seem very definitely to extend the application of salt treatments to this important field.

(h) *Miscellaneous structures within building code jurisdictions*—In metropolitan areas, more costly construction is usually necessitated because of code requirements pertaining to the use of "non-combustible" materials for construction. In many instances fire-treated wood will meet code requirements and thus promote construction economy.

(i) *Reducing fire hazards in existing wooden buildings*—Since it is impossible to reconstruct the present wooden structures making up a railroad system, much fire prevention

work can be accomplished in the general routine maintenance of these structures.

It would be well to adopt a definite rule that when making major repairs or additions to any important building, first consideration should be given to the use of fire-retardant materials. A good example of this would be in the maintenance of wooden smoke jacks in little-used enginehouses. On most roads metal or asbestos-cement jacks are used exclusively, but occasionally an old enginehouse does not warrant the expense of installing either of these types of materials and wooden jacks are maintained until such time as the terminal can be abandoned.

A very important contribution to the non-combustibility of existing untreated wood structures can be effected by providing partitions and curtains of relatively thin, fire-treated lumber or plywood sheathing, and by enclosing trusses and covering important members with these same materials. Furthermore, a large amount of inside ceiling material can be used to make partitions, lockers, and all sorts of conveniences. If this material is plywood of fire-retardant quality, many fires can be prevented.

For the railroads to obtain the protection afforded by this treated material, a definite building code should be established to be followed for new construction and routine maintenance. The planning for new construction affords plenty of time to acquire treated material for entire structures, and a small amount can be stocked to cover routine maintenance.

Specifications

Your committee considers it inappropriate at this time to submit a specification for the fire-retardant treatment of wood. In view of numerous existing but for the most part, recently promulgated specifications, it is the opinion of the committee that reference only should be made to these for the convenience of anyone desiring to study their several requirements in detail. Furthermore, there is no inclination on the part of the committee to recommend any particular specification, but rather to point out what, in its judgment, are the essential considerations to be kept in mind in the selection of a suitable specification.

The chemicals to be employed in fire-retardant treatments should be studied carefully with a view to determining (a) their effectiveness as fire and flame spread inhibitors; (b) their stability in the formulation of which each ingredient is a part; (c) their effect on the wood and its fastenings, on treating equipment, and on those handling them or subjected to the fumes from the treated wood when heat or fire is applied; and (d) other characteristics, such as solubility, hygroscopicity, leachability, etc., particularly in connection with the retention to be specified in the wood.

Performance Tests

The requirements pertaining to treating practice and acceptance of material usually provide for (a) performance tests only; or (b) definite chemical formulations, together with penetration and retention requirements; or (c) both of the above. The committee is of the opinion that requirement (a), performance tests, is to be preferred, regardless of what chemicals may be employed or their penetration and retention in the wood.

The selection and preparation of test specimens to reflect most closely the performance of the wood under actual service conditions, as well as the several methods of testing, involve several questions so far as an accurate measure of service behavior is concerned. The committee is inclined to take the view that these questions are of a relative nature and that their exact evaluation is likely to be largely of academic interest and importance. Thus, it is well established that treated lumber prepared in accordance with any of the currently used specifications, and meeting the "fire-tube" or "crib" tests, as the case may be, will render satisfactory service when incorporated in structures, wherever or whatever they may be. It is appropriate to observe, however, that for comparable weight loss requirements, the crib test is undoubtedly more severe than the fire-tube test. Thus, the relative importance of a structure may be the deciding factor in determining the testing procedure to be adopted in the specifications.

Underwriters' Specifications

Attention is also directed to the laboratory test developed by the Underwriters' Laboratories, Inc., Chicago. A description of this test will be found in the American Railway Engineering Association report of Committee 6—Buildings (December, 1943). This test is made in a large furnace, with all factors controlled during the test, and the combustibility of the treated wood is compared with that of untreated red oak with a combustibility rating of 100.

There are a number of current specifications and studies relating to this subject. The American Railway Engineering Association in its Committee 6 Report (March, 1944) submitted a proposed "Specification for Fire-Resistive Treatment of Timbers and Lumber," and it is understood that some railroads have purchased material under this specification. Accordingly, the committee desires to call attention to this specification which, presumably, has been "tailored" to meet the specific needs of the railroads.

Where the manufacturer has demonstrated that his product conforms to the specification requirements outlined in their report of June, 1943 (Retardant 2755), the Underwriters' laboratories propose to furnish an "Underwriters' Certificate" covering the treated wood in question. Thus, the consumer will be able to purchase fire-treated wood bearing the Underwriters' Certificate, and thereby avoid the difficulty and annoyance involved in following the customary practice of buying on specifications and testing. At the present time, the Underwriters' Certificate is applicable only to southern yellow pine and Douglas fir lumber treated with chromated zinc chloride. Presumably, the scope will be widened to include other treatments as manufacturers apply to the Underwriters for recognition, subject to their prescribed tests.

The following classification of fire-treated wood is based on various retentions of dry salts per cubic foot of one inch lumber, compared with untreated oak as 100:

Fire Hazard Classification

	Retention—lb. per cu. ft.			
	1	2	3	4
Flame spread	60	40	35	30
Fuel contributed	50	35	30	25
Smoke developed—	Less than untreated wood			

The Underwriters' Certificate is based on lumber one-inch thick, completely penetrated with the treating solution. However, material of any size or thickness should qualify for a certificate if it has at least one inch of penetration of the treating solution on all surfaces. Obviously, in such cases, the fire hazard classification would be at least equal to, and probably more favorable than, that for thinner materials, because of volumetric absorption of the treating solution.

It is probably true that maximum decay and maximum fire hazard do not always occur in the same part or location of most buildings or other structures. Consequently, a combination decay and fire-resistant treatment may not always be required. However, because of the fact that preservative salts contribute to fire resistance, a two-fold advantage is derived from their use. Consequently, there is much to be gained and little, if anything, to be lost in the

combination treatment. On the other hand, many structures or their parts are subject to extremes of each hazard, operating simultaneously or alternately. A good example is the case of bridge ties, enginehouse roofs, car-thawing sheds, etc.

Tests conducted for the Bureau of Yards and Docks (Navy Department) (see Civil Engineering, November, 1943, page 529) indicated, for salt injections of about 4 lb. per cu. ft., a decrease in fiber strength in static bending and compression parallel to the grain of about 10 per cent, and in compression perpendicular to the grain of about 3 per cent. End and radial hardness was increased as much as 25 per cent. Probably the results pertaining to flexural and compressive strength were affected by the incising of the specimens before treatment. During 1942 and 1943 the Navy Department used more than 50 million feet board measure of fire-resistant-treated timber and lumber in the construction of blimp hangars.

The committee is mindful of the fact that wood treated to reduce, or even to nullify, its combustibility, important as it is, is not the sole noncombustible material available for rendering buildings and structures less vulnerable to fire. It subscribes to no single material as a cure-all for all of the perplexing difficulties involved in building construction, particularly in the railway field, where the fire hazard is relatively severe. At the same time, the committee is not inclined to explore and report upon fields of activity which lie outside the bounds of its instructions, which clearly limit its efforts to a consideration of wood.

It is appropriate to observe that wood possesses some of the very properties needed most urgently for maximum protection in case of fire; heavy timbers, even when untreated, have, by actual test, greater resistance to reduction in strength from fire than steel, and their load-carrying capacity is impaired at a much slower rate than steel when exposed to the same temperature. Thus, wooden structures often may be saved because of the additional margin of time afforded for bringing a fire under control. At the same time, its excellent insulating qualities are most important in impeding fire and in permitting the close approach of fire-fighting equipment. This property is of particular importance where partitions, doors, curtain walls, coverings, etc., are employed in preventing the transmission of high temperatures to adjacent vulnerable areas or members.

In the final analysis, the reduction of fire hazard, whether as a matter of new construction or maintenance, should be achieved at a price consistent with the exigencies of the situation. Whatever that may be, the principle of obtaining the maximum protection at the lowest cost, under the specific existing conditions, should prevail. In line with that principle, each material and process or method must stand on its own merits.

Committee—J. F. Seiler (chairman), prin. engr., Service bureau, American Wood-Preservers' Association, Chicago; O. W. Stephens (vice-chairman), asst. engr. str., D. & H., Albany, N. Y.; H. M. Church, gen. supvr. b. & b., C. & O., Richmond, Va.; M. H. Dick, man. ed., *Railway Engineering and Maintenance*, Chicago; A. G. Dorland, asst. engr., E. J. & E., Joliet, Ill.; H. W. Hauerslev, ch. drafts.; C. M. St. P. & P., Chicago; F. W. Hillman, asst. engr. m., C. & N. W., Chicago; F. W. Hutcheson, asst. supvr. b. & b., C. & O., Newport News, Va.; W. V. Kerns, supvr. tim. pres., C. & N. W., Escanaba, Mich.; W. F. Martens, gen. fore. b. & b. & w. s., A. T. & S. F., San Bernardino, Cal.; J. W. Martin, fire & tunnel insp., S. P., Sacramento, Cal.; P. F. McNally, asst. b. & b. supvr., S. P., Salt Lake City, Utah; L. R. Morgan, fire prev. engr., N. Y. C., Detroit.

B. & B. SECTION

Keeping Work Equipment in Service

Report of Committee

IT IS a recognized fact that under normal conditions the economic justification for the use of work equipment depends very largely upon the extent to which it can be kept in service. As the result of conditions growing out of the war, however, there are other factors to be considered in the employment of such equipment, some of which assume equal proportions, and even overshadow economic considerations.

The present shortage of labor demands that work equipment be utilized to its fullest extent. The term "labor-saving devices", so long applied to maintenance of way work equipment, was never more appropriate than at the present time, when one road, for example, reports a shortage of 2,163 employees, 790 of which are section and bridge and building laborers. If it were not for the labor-saving equipment in use on this railroad, its shortage of labor would be far greater.

The full utilization of work equipment requires careful study on the part of supervisory officers. Because of its importance in saving labor, and the difficulty in obtaining new equipment, the maximum use should be obtained from all equipment now in service. To secure this result requires the careful assignment of all equipment, and a definite, comprehensive schedule of its use. Whether a machine is assigned to the system as a whole, or to a region, a division, or a district, a comprehensive schedule of its work must be followed to insure that it is being utilized to the fullest extent. Such a schedule should be based upon careful studies of the work to be done, when it should be done, and the adaptability of the machines and tools to the work and to the force to be employed—always with a view to the maximum economy in the employment of labor. It is not enough simply to set up a schedule and then forget about it. It is the responsibility of supervisory officers to see that such schedules are maintained.

Good operation is one of the primary factors in keeping work equipment in service. Careful, efficient, well-trained operators are essential both to good operation and to long continued service. Failures and breakdowns will occur with the most careful operation, but a very large percentage of such failures can be avoided if the equipment is given careful, intelligent operation. Unfortunately, the same careful thought and consideration given to the selection of new work equipment are not always given to the selection of operators, and yet, this is of vital importance. Time spent in the selection of the most effective units of work equipment is time wasted if the equipment is turned over to careless, inefficient operators. The supervisory officer responsible for the output of work equipment should have jurisdiction over the men who are to operate it, and should have sufficient knowledge of the equipment to know that it is being operated properly.

The power machines and tools now in service are, with few exceptions, the result of years of careful study

and experiment on the part of their builders, and the weak points common to machines in their earlier years of development have been largely eliminated. As a result, there are many examples of long uninterrupted service from these machines where they have been handled by competent operators. On the other hand, almost constant trouble has been experienced with the same types of machines where they have been poorly operated. It can be said safely that 50 per cent of the failures that occur in work equipment are due to faulty operation or to failure to take care of running repairs properly.

Operators

In selecting and training operators for work equipment, your committee recommends the picking out of bright young men who have indicated a special interest in work equipment—especially those who may have taken courses in gas engines and machinery in high or preparatory schools. These men, when possible, should be assigned as helpers to the regular operators, where they can become acquainted with the equipment and how to use and maintain it. When an opening comes, these men should be promoted in accordance with their seniority.

Mistakes are certain to be made in trying to select new operators, and it may be found necessary upon occasion to tell men frankly that they are not adapted to or capable of being work equipment operators. In most cases, being so told, they will resign and will try to fit into some other kind of work. This action must be taken, because if a man is unsuited as an operator, he must not be allowed to damage valuable equipment. In fact, no new operator should be kept in training any longer than it takes to determine whether or not he has an aptitude to become an efficient operator.

Labor organizations have been reasonable in assisting in replacing men who are not qualified to operate machines, because they realize that a man must be efficient and capable to operate present-day equipment. By consulting them when it has been found that an operator is not qualified, they have usually shown willingness to cooperate in securing a man who is qualified, and to have the present operator removed to another job.

After becoming familiar with the machine, an apprentice should be given an opportunity to operate it when idle, or, when it is doing some job that does not require maximum output. In this way he will become qualified to take charge of the equipment in the absence of the regular operator. In some cases, a little pressure may be required to get the regular operator to co-operate with the apprentice, because, from a selfish standpoint, or because of some organization affiliation, he may be reluctant to train a man who could take his place. Where this difficulty is encountered, the regular operator must be given to understand the importance of training an assistant who can take over the work in his absence, or who can become qualified to operate another machine of the same type.

Field Maintenance

Adequate field maintenance will keep power machines at work and out of the shop. Daily inspection of all work equipment should be made by their operators, and the supervisor in charge of the work should check up frequently enough to assure himself that the equipment is being operated properly and is not being neglected. In some cases it has been found advisable to employ field maintainers to make in the field those repairs that are beyond the ability of the operator. A good field maintainer can do much toward keeping the equipment in service by correcting conditions in the field that, if not handled promptly, might cause a serious breakdown with resultant delays. Among the duties of such a maintainer, he should determine the rate of wear on machines so that the necessary parts for replacement can be ordered and secured by the time they will be needed. Another, and not the least important of the duties of the field maintainer, should be to instruct and advise operators in the care and handling of their machines.

Motor cars should be inspected by the foremen each time they are used, and by a mechanic as often as possible, in order to avoid accidents. We need all of our men, and a cripple is no asset to any railroad.

For all practical purposes, a daily inspection of all mechanical equipment should be made by the operator, and a thorough inspection should be made whenever the equipment is sent to the shop. Running repairs can generally be made in the field by the operator, and to permit this, it has been found practical in many cases to carry some light repair parts with the equipment, especially those parts that have been found to break or wear out frequently.

Shop Repairs

Where there is a general breakdown of a machine, or it has become worn out, it should be returned to the division shop for a general overhauling. This, when possible, should be done at the end of the season, or when the particular equipment involved is not needed in current work. Such machines as pile drivers, locomotive cranes, shovels and draglines can be repaired more readily at a system shop, as such shops are prepared to handle this heavier equipment.

It is not possible to set forth a plan for the maintenance of work equipment that will be suited to all railroads. In general, however, on short roads, general repairs or overhauling should be done at a system shop. On larger roads, such heavy repairs and overhauling should be done in a division shop. In both cases, the operator of the equipment, and his helper, if possible, should assist in the repair work in order to learn how to make the repairs and how to keep the equipment in shape to produce the greatest efficiency. In any event, division officers should see that all equipment is properly cared for and properly operated. They should also see that the men responsible for operating and repairing their equipment have the proper tools with which to work. It is not hard to get men who like to operate good equipment, and who will keep it in good shape if they have the proper tools to do so.

Seasonal Equipment

Much has been said regarding the use of seasonal equipment. While it is true that such equipment presents its own particular problems, much equipment designed primarily for seasonal work can be utilized to good advantage during the off-season periods by carefully scheduling its work. Work equipment is sometimes allowed to remain idle because there is no immediate need for it on the particular district or division to which it has been assigned. This should be avoided, and such equipment should be reassigned to points where needed, because this is no time to permit useable work equipment to remain idle. Daily or even weekly reports on each machine will show whether it is being used, or whether it is being allowed to remain idle.

Conclusion

Summing up the foregoing, the committee offers the following conclusion: Keeping work equipment in service requires the careful scheduling of both work and equipment; good operation; adequate field maintenance; co-operation between operators and supervisory officers; and maximum use of seasonal equipment.

John E. Bird (chairman), asst. supvr.,

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B. & B. SECTION

The Year's Developments in Labor

Report of Committee

SO far as it had affected the forces and the work of the bridge and building department of the railways during the previous year, the labor situation, as of October 1943, was presented to this association at its war-time conference in 1943, by both a formal report on the subject and addresses by men closely in touch with the railway-employment situation.

While some changes have occurred since these reports were presented, they have been more in degree than in character. This year began with a marked shortage in the semi-skilled and unskilled classifications. However, on most of the northern roads, where work by these forces is somewhat curtailed during the winter months, the labor requirements were eased considerably during this period, only to become still more acute with the opening of the active working season.

G. E. Boyd
Chairman

Situation Has Grown Worse

In general, primarily because more men were needed during the working season, the situation has grown worse as the season advanced, although several roads reported a perceptible improvement since the first of the calendar year; yet these roads also reported that they were still short of men in practically all classifications. In most, but not all, cases, these roads are in sections where a large number of federal projects have been under way. As the construction of camps, air fields, ship yards and other similar undertakings, has been completed or neared completion, men were released. If they were local residents, some of them became available for railway employment, and a relatively small number were obtained from this source. A still smaller number of roads reported no general shortage of bridge and building men, but all in this group were faced with local shortages, particularly around war plants. A few roads have an ample force of carpenters, but are short of semi-skilled and unskilled labor.

Questionnaires requesting information concerning the labor situation as it has affected the bridge and building forces on their own lines were sent to a selected number of railways and replies were received from 23 of these roads, with a line mileage of more than 125,000, representing every section of the United States and Canada. Numerically, shortages were reported ranging from a total of 49 to a total of 322 men, including all categories. Other roads placed their reports on a percentage basis, showing shortages of from 5 to 60 per cent for the systems as a whole, with several roads reporting shortages as high as 75 per cent on certain districts outside industrial areas, and a total absence of men in some areas around war plants. In the main, however, the shortages reported ranged from 20 to 40 per cent.

Although a few roads reported that they had enough carpenters, others reported shortages in this category ranging numerically from 20 to 246 or, on a percentage basis, from 10 to 60 per cent, with local shortages approaching 100 per cent. In some cases, these shortages were largely in bridge carpenters; in others the building gangs were most affected; while several roads emphasized their need for structural steel men. With one or two exceptions, the most pronounced shortages were reported in the semi-skilled and unskilled classifications, that is, among helpers and laborers.

Labor Supply Exhausted

With no exceptions, the reports stated that no source of labor in any of these classifications is left to draw from. On the other hand, several roads said that they had been able to pick up an occasional skilled or semi-skilled man—enough to offset those who were dropping out of the service from time to time. While absence of any reservoir of labor available for bridge and building work is a general condition, several roads were able to hire a few men who were being released from federal projects as they neared completion, although not all of these men remained long in the service, but as one engineer maintenance of way remarked, "every man retained is that much gain." Another road that passes through highly industrialized areas reported that there is at present a small but discernible movement from war industries to railway jobs by men who believe that victory is not far off, and who desire to establish themselves in permanent jobs that will at least see them through the post-war adjustment period. This movement is said to be most noticeable along the eastern seaboard.

Reports also indicate that in certain metropolitan centers there is an ample supply of carpenters and painters, but that they will not go out on the road to work or live in boarding cars or camps. In other centers, there are enough carpenters, not working, to fill the requirements for bridge and building men, but they demand the local union scale

and will not work for the lower rates paid by the railways.

Peculiarly enough, in view of the critical shortage in the skilled and semi-skilled classifications for bridge and building work, all but a few of the roads reporting said that they have enough water service men to meet present requirements, and most of those that were short were not affected to a serious degree. However, one road reported a deficiency of 30 per cent, and two others were short 10 per cent. Two of the roads that are short only a few men said that it has now become almost impossible to hire competent water service mechanics. In general, the situation with respect to laborers in this department does not differ from that for bridge and building work.

Effect of Wages

An effort was made to determine the extent to which wage rates had affected the ability to hold men already in the service and whether they are increasing the difficulty of recruiting men now. It was the general belief that the higher wages offered by contractors on federal construction projects and by war industries had been a major factor in both the loss of men, other than those who entered the armed forces, and the difficulty experienced in recruiting men to make up these losses. Yet it was stated with almost equal unanimity that, with the exception of the metropolitan centers already mentioned, the differential in wages between industry and the railways is having a negligible influence at present because of the almost complete absence of men available for the jobs that are open. As confirmation, more than one officer who discussed this phase of the situation pointed out that industry is experiencing the same difficulties as the railways in recruiting men.

It was also generally agreed that this wage differential is not a factor at present in holding men, for all of those who were attracted by higher wages are gone, and those that remain have stronger reasons than the wage differentials for staying with the railways. The men who left for higher rates of pay were the younger men who had acquired little seniority, yet some of them were attracted as much by the possibility of deferment from miliary service, because of employment in essential war work, as by the difference in wages. Those who have remained ranked high on the seniority list, in addition to which they have a prescriptive right in the pension fund, under the Railroad Retirement Act, both of which would be lost if they gave up their employment with the railway.

Most roads are endeavoring to meet the situation by increasing the hours worked to 9 or 10, partly to increase the income of men in the department, since the rate of pay is frozen, and partly to increase the output of the forces they are working. Attention was called to the fact that an extension of the working day from 8 to 10 hours is the equivalent of an increase of 25 per cent in the forces actually employed. A few reported that they had made no increase in the hours worked. In one case this had been left to the men, who decided against the longer day. In another case, the day was lengthened, but the men objected and were put back on eight hours.

Men Board Themselves

On practically all roads, bridge gangs are housed in camp cars and board themselves, the railway furnishing only the cook. Most of the building gangs are housed in the same way and board themselves in like manner. During the last few years, most of the roads assisting in this survey have endeavored to improve the condition of the camp cars and the camps as a whole by painting, by better interior finish of the cars, by the installation of electric lights and in other ways that have presented themselves. This movement has been considerably accelerated in an effort to attract men, and in a number of cases shower baths and modern toilet facilities have been added. In some instances also, lounging cars are included in the outfits.

With two exceptions, the roads under study have done nothing about the feeding of bridge and building or water service gangs in mobile camps. In one of these exceptions, arrangements have been made for the commissary department to supervise the purchases of food, with the dual purpose of improving its quality and of holding down costs. In the other, the railway is absorbing two-thirds of the cost of the meals. None of the other roads included in this study are absorbing any part of the cost of the meals, and all of them allow the men to buy their food as they have always done.

Almost every method for recruiting skilled, semi-skilled and unskilled labor has been tried that could be used legitimately to bring men in either singly or in groups. In the early days of the labor shortage most of the roads advertised their needs in the local newspapers along their lines, and some of them reported considerable success. More recently, however, this method has not been very productive, although it still accounts for a few men who can be employed. Some success was also reported as a result of displaying placards in the towns served by certain lines. However, most of the men who can be reached by these forms of advertising are men with families, who can find enough work locally to keep them busy, and most of whom do not favor the idea of living in camp cars.

Many roads have called on supervisors and foremen to discover and solicit prospective workers. They have also appealed to the men in the gangs to solicit such of their friends and acquaintances as may be available. A considerable number of men have been obtained in this way, who have usually been superior to those obtained through other methods, for the men who have done the solicitation have generally known their capabilities beforehand. Like other methods, however, the results are less productive now than they were last year, or even in the early part of the present season.

Some roads have established their own labor agencies; some have worked through the established private agencies upon which they have been accustomed to rely in the past for most of their labor needs; but all of them have come more and more to work through the Railroad Retirement Board and the United States Employment Service. Since July 1, the Railroad Retirement Board has been designated as the sole recruiting agency for all classes of railway labor, and this will be discussed more fully later.

Many Expedients Tried

Specific inquiry was made concerning ways and means adopted to increase the supply of bridge and building labor, including the recalling of pensioned employees and the deferment of those reaching the retirement age. Some roads reported that they had given retired employees the privilege of returning to work during the emergency, and that a small number had responded. This experiment was generally without success, however, for few of those who had been retired for any considerable time were found able to stand up under the effort necessary to perform their duties, even though they appeared to be in good physical condition. Apparently they had lost the physical reserves that they possessed prior to their retirement, and they did not have the resilience necessary to "come back."

On the other hand, most of the roads reported that, while the number of men reaching the retirement age during the last two years was small, most of them were physically able to continue work, and that, with few exceptions, they were glad to remain in the service during the emergency. In fact, they felt that it was their patriotic duty to do so.

In general, the age limits for accepting new employees have been extended both upwards and downwards. Boys as young as 17 years have been employed in those states that do not prohibit employment at this age. In some cases, where the laws were such as to make the employment at this age of doubtful legality, the problem has been solved by obtaining permission from the state labor department to do so. While a few roads reported little success with boys in the bridge and building forces, others reported that, with good supervision and careful attention to training, they were making satisfactory workmen. As a matter of fact, two roads reported that they were doing better work than some of the older employees who have remained in the service.

Although the roads expressed a preference for men who have had some experience, the practical impossibility of obtaining any considerable number of such men under present conditions has caused an almost complete relaxation of this requirement. While some relaxation was also reported in physical requirements, this has not gone so far as for the track forces, and some roads have reduced their requirements only slightly. One or two other roads now require no physical examinations, except for foremen, and still another road reported that it allows a period of 60 days after employment before the physical examination is given.

Under the conditions that have been mentioned, the employment of boys of high-school age has been widespread, only a few roads reporting that they did not have some boys working full time during the vacation period. Their employment part time, that is, over the week ends during the school year, has not been on so large a scale as in the track forces, partly because it is less easy to get them to and from bridge and building gangs for the short time they are available for work, especially when the gangs are working at isolated points.

No Part-Time Employees

None of the roads reporting have recruited part-time employees, from either their own offices or from outside sources, for bridge and building work, and none of them have employed women on this class of work, although both of these expedients have been successful for other classes of work. The fact that most bridge and building gangs live in mobile camps, that is, boarding cars, and that many of them work regularly far from headquarters, militates against part-time employment as well as against the inclusion of women in this work. The only exception to the employment of women, and this is being done by many roads, was that women are being employed as cooks in these camps if their husbands are members of the gangs in which they work.

A number of roads have found it possible to pick up a few men, temporarily, in the localities in which gangs were working, by providing transportation for these men between their homes and the site of the work. Practically none of the men so employed could be induced to work at distances greater than, say, a radius of 50 miles, because they were unwilling to remain away from their families over night. While not very general, this expedient has been successful in a considerable number of cases.

Discharged soldiers who had worked for the railways prior to their induction into the armed forces have been returned to their jobs automatically, provided they were physically able to perform the work for which they were otherwise fitted. Priority has also been given to discharged soldiers who were not previously employed, under the same conditions. So far, the reports indicate, only a negligible few soldiers have applied for jobs. Likewise, most roads stand ready to employ those who have been classified as 4-F, if they can meet physical requirements.

Effectiveness Lower

A study was made of the relative over-all effectiveness of bridge and building labor at present, and of newly-employed and the regular forces separately. With only one exception, it was the definite experience of the officers who participated, and of the members of the committee, that there has been a marked letdown in production. One officer stated that although he now has more men on bridge and building work than formerly, he is getting less work done. A large part of this reduction was attributed to lack of experience on the part of the new men. In this connection, another officer remarked that it requires a long time to train a man to perform

B. & B. SECTION

railway work in the manner that is required. Again, many of the men who have been taken on in recent months have not been trained in team work, and thus slow down the work.

Another factor that was mentioned was that many of the new men are past the years of greatest agility and cannot work as fast or get around on ladders and staging as well as younger men whom they have replaced. One officer also stated that most of the men he had been able to obtain had been discharged from war industries because they had been unable to maintain the tempo of production that was demanded of them. It was also stated that part of the men who were taken on were men who suffered from chronic unemployment, and that they had been far less than satisfactory and had tended to slow down the work. While the high-school boys that had been employed were alert and nimble, they lacked experience and showed a tendency to be impulsive, so that they required considerable attention from both the foreman and the regular employees, working with them.

While the primary reason given for the drop in production by the regular men was said to be that many of them were in the older-age brackets, a number of officers stated that an important reason was that they were compelled to give so much attention to the training and safety of the new men that they were unable to give undivided attention to their own work. Reduced to specific comparisons, the reports indicated that the effectiveness of the new men now ranges from 50 to 75 per cent of that of the regular forces during normal times, while that of the regular employees ranges from 65 to 90 per cent of the pre-war standard.

Priority Referral Plan

The foregoing discussion has described the labor situation as it existed prior to July 1. On that date the War Manpower Commission put into effect what is known as the Priority Referral Plan, which goes well beyond any previous labor-stabilization order. The purpose of the plan is, first, to establish a nation-wide system of priority referrals, which provides that employers shall hire only those male workers that are referred to them by the

War Manpower Commission, the United States Employment Service or other appointed agency; second, it will fix the number of men who may be employed in specific establishments in the 184 areas of labor shortage, as defined by the War Manpower Commission; third, it will create area man-power-priority committees that will determine which industries in their respective areas are entitled to priorities in the referral of available male labor; and, fourth, it will intensify the recruiting activities of the United States Employment Service and its agents, so that men may be transferred from areas of labor surplus into those areas where urgent war production requires more labor.

The Railroad Retirement Board, subject to certain limitations, has been given the primary responsibility for recruiting all railway labor, acting for the railways in the same manner as the United States Employment Service does for other essential industries. Under this plan, therefore, the railways must place all orders for labor, both skilled and unskilled, with the Railroad Retirement Board, and men can now be hired only through this board. This requirement covers high-school boys, except that certain age limits are excluded in some areas. However, in outlying districts, under certain restrictions, where it would be impracticable for the prospective employee to travel to the office of the board, the railway can make arrangements to hire men temporarily and later obtain clearance through the retirement board, that is, within a period of seven days from the date of employment. This, in brief, is an outline of the plan as it was issued. There are numerous exceptions to meet local or changed conditions and to simplify procedure in the interest of both employer and employee, but it does indicate the necessity for close co-operation at all times with the board if labor is to be obtained.

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Post-War Values of War-Time Practices In Bridge, Building and Water Service Activities

Report of Committee

AMERICA'S entry into the war required the marshalling of all forces of the nation—its raw materials, finished products, labor, management and best minds—and directing them to a single purpose—that of overcoming the enemy. The exigency of peril necessitates the prompt concentration of strength, and the resultant abrupt change from peace-time to war-time pursuits causes some confusion and manifold problems. Yet, through it all, reason generally prevails, order is brought out of chaos, problems are met and solved, and some good lessons are learned that prove of benefit to the nation in the post-war period. The subject of our committee study is the consideration of lessons that railroad bridge and building men have learned from war-time practices.

E. H. Barnhart
Chairman

War-Time Practices

When we were plunged into the greatest war the world has ever known, railroad managements were confronted almost overnight with the necessity of changing operating and maintenance practices from those necessary to meet competition, with small allotments, to those involved in the stupendous task of moving the men and materials required for the war effort. Although increasing passenger and freight business called for the extension of facilities, it became evident that the usual materials could not be obtained for such new construction. Naturally, steel was the first material restricted, followed closely by copper, brass, aluminum and other metals which are essential to the maintenance of bridges, buildings and water service facilities. Gradually, restrictions were imposed on a great many other critical materials.

Federal bureaus were set up to allocate these critical materials, so that during the second year of the war it was difficult to obtain many metal and wood products without proper approval and allocation from federal authorities. The result of this was the slowing up of maintenance projects, the need for programming maintenance work far ahead of schedule, and the use of substitute materials.

Programming of Work

Prior to the war years, it was the custom for many railroads to prepare programs for repairs to bridges, buildings and water service facilities during the late fall, to be carried out during the succeeding year. These were usually approved by the management during the early part of the new year, and requisitions for materials were submitted during the late winter. Deliveries of materials were usually effected within 60 days.

When these programs were made under pre-war conditions, little thought was given to the inability of securing reasonable deliveries of materials, but with the imposition of restrictions by war conditions, it became necessary for maintenance men to revise their programs ma-

terially. Some items could be deferred, but the most urgent required the use of substitute materials. Steel bridge repairs had to be deferred until substitute materials could be obtained, or priorities requested and secured for standard materials where repairs could not be made with substitute materials. In many cases, wood "helpers" were used to tide over an emergency. During the early part of the war, building repairs were at a standstill. Often the entire efforts of the bridge and building forces were required on bridges.

Changing Water Requirements

The water service department did not suffer as severe curtailment in its work, due to the inability to obtain materials, as did the other departments. This was due partly to the practice on many roads of keeping an ample stock of spare parts for replacement. Thus, this department was able to function nearly normally. Then, too, the substitution of other types of motive power for steam had reduced materially the demands on water service facilities on a number of roads. Prior to the advent of the war, many water stations were out of service, and, if not entirely dismantled, their machinery was available for transfer to other points. On the other hand, the additional traffic brought about by the war required placing some of these abandoned water stations back into service, and if a railroad had not fortified itself with a stock of repair parts, it was confronted with a serious situation.

Gradually, the federal priorities bureaus began to function, and toward the close of the first year of the war, the importance of rail transportation systems began to be recognized. In fact, in many cases the railroads were granted priorities that were second only to those necessary for the direct prosecution of the war.

It may be noted that in the war-time programming of maintenance, the general practice has been to spread the work over a maximum number of small projects, rather than to concentrate it on a few large projects. During this third year of the war, bridge and building forces are again endeavoring to confine their repairs to bridges to those that do not require critical materials. Work is being programmed sufficiently in advance to get delivery of materials, under priorities, when necessary, with due regard to the ability of manufacturers to make such deliveries. Substitute materials are being used wherever possible, and steel work is being deferred where this can be done without detriment to the structure.

Because of the inability to secure an ample supply of skilled and unskilled labor, much work on concrete structures and buildings is being contracted. Paint is generally available, a fact which has resulted in a large amount of painting being done, both to preserve structures and to place them in a more presentable condition. As priorities will permit and deliveries can be obtained, a considerable amount of labor saving machinery is being purchased. In many cases this machinery is replacing obsolete or wornout machinery, with the result of increasing the efficiency of the available labor.

Lumber is becoming increasingly difficult to obtain, requiring the substitution of composition, cement and plastic materials. Building men have learned to use these substitutes to good advantage.

In some cases, outmoded, steam-operated water stations have been replaced by automatic electric stations, using second-hand motors and pumps available from other points. This is a good example of what can be done to get rid of existing obsolete facilities, and, at the same time, effect savings in man-power. No doubt, any water service man could find such a condition on his own railroad and correct it as cited above.

Contrast of Practices

Such are our war-time practices in the bridge, building and water service fields. How do they compare with our peace-time work? In peace-time, all work is programmed, and large projects are planned when the necessary funds are available. In war-time, as financial ability increases, the actual ability to perform work decreases with the unavailability of critical materials and the necessary labor deciding factors.

In peace-time, materials are usually requisitioned from two weeks to sixty days in advance of their need, with no approval of federal authorities necessary for their procurement. In war-time, on the other hand, six to nine months' advance notice is required by the stores departments, and many federal forms must be prepared in order to obtain critical materials. During the interim between the request for materials and their actual delivery, close co-operation with the stores department should be established and maintained, so that the workmen can be sent to the site of the project at the proper time.

Prior to the war, many steel bridges and other structures were built because of the permanence involved in this type of construction. Various steel specifications were used, and shapes of many kinds were available. The war changed these practices to the extent that fewer steel structures have been built because of the shortage of steel and the required priorities. War has given great stimulus to the making of alloy steels and other metals with added strength, extra toughness and other desirable characteristics, but these will not be available to the railroads until the end of hostilities.

In war-time, replaced steel members or spans are carefully inspected, dismantled if necessary, and re-used in lighter duty where possible, and the condition of the steel must be very poor, indeed, before it is cut up for scrap. Welding has come rapidly to the fore and many structures are being strengthened by this process. Many recovered turntables and bridge spans are shortened, refabricated by welding and re-used.

B. & B. SECTION

Substitute Materials

Since substitute materials are playing a rather prominent part in war-time needs, what will their effect be, both on the life of the structures and their use, when the original materials are again obtainable? Both pre-war and peace-time practices involve the use of so-called "standard" materials. The bridge and building forces have been trained in standard practices, so that it is often difficult to get them to use substitutes. In some cases, no doubt, substitutes will replace the old, so-called, standard materials—as in the case of plastic hardware, fluorescent lighting, and perhaps, synthetic rubber.

But by far the most important lesson that will be learned from our war-time experiences is the use of second-hand usable material instead of new material. Too much usable material has been wasted on the railroads in the past. Improved methods of concrete construction, as well as gypsum substitute products and glass, will replace metal products in post-war building work to a large extent. The lumber shortage, and, in some cases, the requirement of high priorities, has made necessary the more extensive use of brick, tile and asbestos products. The shortage of lumber will result in

more extensive use of these materials.

Research, particularly during war periods, usually discovers new products and new and improved methods of manufacture. The present war period has been productive of just such results and many of the new materials developed are certain to supplant old standard materials.

It is the duty of every bridge and building man to study carefully the use and service of substitute materials so that he will be in a position to discard those not effective.

War Lessons

War has taught railway bridge and building officers many things—to plan carefully their material needs, with no excess permitted on requisitions; to work with an exceedingly low material inventory and to search all possible sources on the line for the recovery of good second-hand materials; to allow no waste and to have all unused material, both new and second-hand, picked up promptly and retained for other uses; to work closely with the stores departments; to use power tools extensively, and to schedule and preserve them in good operating condition; to release cars promptly; to exercise ingenuity in substituting one material for another which may not be available; to take more interest in the welfare of their employees, and to train them and provide them with closer supervision.

While it is not expected that conversion from war-time to post-war conditions will be sudden, it is reasonably certain that both labor rates and material values will be reduced gradually to lower levels. Bridge and building supervisors must be prepared for this conversion. The return of millions of men from the armed services will provide an abundance of labor. Post-war projects involving new and improved facilities to effect operating economies should be planned, studied, and, where possible, some materials should be assembled, so that when restricted maintenance allotments are in force, work will be available for employees. The maintenance forces should study their post-war problem, particularly with respect to materials, so they will be in a position to know the materials best suited for use in their post-war construction and maintenance work.

The results obtained through the use of substitute materials can be expected to be projected into the post-war period. The high war-time labor rates in industry, and the consequent high prices of tools, machinery and materials, are certain to affect materially the use of these products in the post-war period. Likewise, maintenance supervisors can expect a reduction in allotments for certain classes of work in the post-war period. Therefore, all the work that can possibly be accomplished during the remaining war period, without interfering with the war effort, should be undertaken now, so that bridge and building structures will be in adequate condition for post-war traffic.

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Welding in Bridge, Building and Water Service

Report of Committee

Geo. S. Crites
Chairman

THE railroads are still confronted with the necessity of making their bridges, buildings and water service facilities outlast the war. Since steel and iron are among our most strategic war materials and must be conserved wherever possible, it is of paramount importance to save every pound of these metals that can be saved. Welding offers a particularly good opportunity to save both material and labor. Since the prime effort of all of us is toward winning the war as quickly as possible, and recognizing that only efforts in this direction should bear weight in our considerations, your committee has confined its report to what is being done and can be done with welding in repairing, enlarging and strengthening existing facilities, in the interest of the war effort.

Recent activities in making hurry-up repairs to ships, guns, machinery, vehicles and countless other articles in active warfare by gas or arc welding impress bridge, building and water service men with the realization of how such welding in the repair of the facilities in their care can contribute to winning the war, and also toward holding such facilities together until materials and labor become available for their renewal or replacement. There is still much to learn about welding in making repairs, but from the stimulus this process is receiving through war applications, enough is already known to insure good results.

The matter of skill and the "personal factor" in welding have been greatly over-emphasized, without enough stress being placed upon the necessity of having the right systems of control and inspection to insure quality workmanship. It is very important that welding operators be qualified in accordance with standard requirements, but with modern equipment, welding does not require a degree of skill that cannot be obtained readily with a reasonable period of good training.

Electric arc welding is now being exploited by some so-called scientific welding schools in a manner similar to the way miniature golf courses were exploited during the early Thirties—and with about the same benefit to the art of welding as the miniature golf exponents gave to

regular golf. Information furnished by well-established firms engaged in research and the development of their own products, with a broad and long-range view to the future, may be used safely and profitably in keeping abreast of the latest acceptable practices in welding.

It is true that the proper selection of rods and electrodes as to types and sizes, as well as the careful selection of the operator, are essential in carrying out any sizable reinforcing or repair job. There will be downhand welding on certain thicknesses of plates and shapes, as well as operations requiring vertical, horizontal and overhead work on different plate thicknesses and various sections and shapes. Rods and electrodes especially designed for vertical and overhead welding, and for both poor fit-up and good fit-up jobs, are designed by most large manufacturers, and it should be decided definitely beforehand what rod or electrode is to be used for each operation. The size and type of "bead," as well as the number of passes to be made, should be specified. Welding operations require a special skill, and also knowledge of the fusing of metals under all conditions, so that it cannot be considered that any welding operator who can hold an arc or light a torch and deposit metal can do safe welding.

Bridges

Both riveted construction and welded construction have their respective places in the field of fabricating, building, reinforcing and maintaining steel bridges. Some of us who are welding-minded may be just as impractical as those who will not concede that welding should replace riveting under any circumstances. When steel plates or shapes are fabricated for riveting, the holes are punched or drilled in cold metal, and when these parts are riveted together in the shop or in the field, only the rivets are heated, so there can be no change in the basic structure of the metal. Furthermore, driven rivets can be tested accurately to make sure that all connections are safe and sound.

If these same plates were sheared and processed for welded construction, additional factors enter into assembling and putting them together. A welder is taught to strike an arc or play a flame, and to manipulate it so that it will melt the steel and amalgamate the contents of the electrode or rod to the molten portion of the pieces to be joined together. Both art and skill are required in holding the arc or flame and in manipulating it so that it will form the right bead that completes the job of fusing the members together. There is an important difference between the performance of the welder and the riveter. Frailties of human nature are more apt to show up in the welder's work, which can cause defects that are hard to detect. The work of the riveter can be checked accurately.

For the duration of the war, at least, welding on railroad bridges should be limited to the repairing, strengthening and remodeling of such structures. Highway bridges, foot bridges and signal bridges can be designed for welded construction throughout, without fear as to strength and soundness, although, at the present time, work on such structures will generally be of a remodeling character.

The design employed in repairing, remodeling, reinforcing and strengthening railroad bridges by welding should stick to simplicity. Remove as few old rivets as possible and fit reinforcing plates and shapes over or around the remaining ones. There is no sense in cutting out a large number of rivets and practically dismantling a bridge where plates and shapes can be welded over, around or between rivets to accomplish the purpose desired.

Welded designs should be planned, insofar as possible, for flat position welding. Welding operators, no matter how skilled, can do a better job in downhand welding than in either vertical or overhead work. Therefore, entire built-up members, such as cross girders, stringers, etc., should be fabricated and welded together in the shop where all welding can be done in a flat position. These members can then be welded into place, even in heavy-duty bridges.

Welding repairs can be made to corroded and deteriorated bridge members with little or no interruption to traffic or train schedules. In many cases extensive falsework can be avoided. However, this cannot be accomplished without proper welding design, careful selection of welding operators, careful training of inspectors, and supervisors who are capable of judging and knowing proper work from start to finish. Avoid the pitfall in the theory that any metal, arc- or flame-welded together in any manner, will stick, and insist upon a complete analysis of each job and of each operation to insure that proper design and welding methods are used throughout.

From many angles, welding has a special appeal in building repairs. The gross sections of the parts repaired are utilized, and since there

B. & B. SECTION

are no rivet or bolt holes to reduce the stressed sections, the full strength of the member is developed. The saving of critical material will be from 10 to 30 per cent. During these times, if a building were not occupied or used intensively, there would be no urgent need for repairing, strengthening or adding to it. The use of rivets in work in a used or occupied building is more or less hazardous, noisy and disagreeable.

The "busting" out of old rivets, driving off of old plates and connections, and other operations in replacing riveted members with riveted members in or about a busily occupied building, is something to be avoided. Train sheds, concourses, shops, engine-houses, coaling stations, traveling cranes and such structures are particularly susceptible to deterioration from the corrosive action of gasses, and are used by the public or by employees both day and night. Avoiding riveting operations on such structures, where it can be arranged, is very desirable.

In repairing, strengthening or adding to the steel members of a building by welding, the building engineer, the inspector, and those in charge of and actually doing the work, and at times the architect, are all vitally interested in a good, strong and neat job. There are no reasons why this cannot be done. Welding supplies and equipment have been developed to a high degree of perfection, so that with proper design, control and inspection, it is possible to do better and more economical work by welding than otherwise.

Recently, the copper downspouts on the loading side of a large warehouse and freight delivery building were so damaged by trucks that they needed extensive repairs. The cast iron base guards were also in bad shape. The copper and cast iron, both critical materials, were salvaged and replaced with old heavy wrought iron pipe for a base, where trucks might contact it, and with old boiler flues for leaders. All was welded together on the ground, and then hoisted into place and fastened there by welding.

Many gutter and downspout renewals were made during the depression by welding oil boiler flues and wrought iron pipe into place, and owing to the greater need today of making what we have available carry on for the duration, insofar

as possible, much more such work is being done on station, shop and roadway buildings. In addition to utilizing available second-hand material, this expedient has the added advantage that the downspouts can be largely shop welded and then welded into place in the field. Usually, wrought iron plates are used for gutter or header connections. Such connections are strong and can be flashed tightly if properly designed.

Around shops and enginehouses, welding on the building structure and appurtenances is practically indispensable. The following may be fabricated or repaired by welding: all-steel ladders; all-welded radiators; collars, hoods and stack fastenings; air and steam exhaust heads; ventilator systems; columns and posts and attachments thereto; and trusses and their attachments. In the welding of columns, posts, frames and trusses, the same procedure, technical study and precautions should be followed as when welding on railroad bridges. Cut out as few rivets as possible, and disturb and remove the minimum amount of corroded steel in members. Remember that the structure is standing, even before any work is done on it, and that it will certainly be strengthened if its members are reinforced as they should be. In other words, do not cut out a lot of steel and use a lot of falsework just because a cutting flame is handy. However, there may be many shelves, angles, plates and attachments to the main members that are there solely for riveting purposes, and are not needed in welding technique. These should be eliminated insofar as possible, as they are usually subject to rapid corrosion.

Turntables, coaling stations and ash pits, under present war traffic conditions, just cannot be taken out of service for any length of time for repairs, strengthening or enlargement, even though they are particularly subject to deterioration from corrosion. However, such structures are particularly adaptable to alteration and repair by welding. Welding work as applied to bridges should be followed on turntables, coaling stations and ash pit runways or frames. The appurtenances of coaling stations and ash pits, such as machinery, buckets, outrigger supports, coal gratings, chutes, gates and aprons, can be repaired, replaced and reinforced by building up worn, broken or corroded parts, by patch welding or by cutting out sections and welding in prefabricated ones. In the latter category, flat position welding can be resorted to in large measure.

There are many appurtenances in and around buildings that lend themselves to repair, improvement or assembly by welding, but here again proper design and methods should be the guide or queer contraptions will result, with too much or too little metal, excessive labor, and a useless consumption of welding energy and material. If proper design is employed, the following subjects may be welded: Machine frames and bearing blocks; cages and platforms; lugs for all purposes; guides on columns; gear covers; machine-oil gutters; all-metal stairs; small brackets, bosses and gussets; small frames; crane and crane runway girders; balcony constructions; heat-resisting furnace covers; shelving, cabinets, cases and lockers; and many others, limited only by expediency and ingenuity.

Where welded members in such facilities or parts may be subjected to stresses or strains similar to those found in railroad bridges, the same welding technique and care should be used as are used in welding on bridges. Proper strength must be provided where strength is needed, but the use of unnecessary labor and materials should be avoided. There are few of us who have not seen freak assemblies by welding, but we have also seen welded assemblies that in form, strength and outline are all that could be desired.

Water Service

When one considers that man for centuries pinned his portion of meat down on the platter with a one-tine instrument and chased it around the platter with a cutting tool, before he thought of making a fork with two tines to hold the meat in place for cutting, and also, when one thinks of the thousands of miles of bell-cord that was worn out each year for the last four or five generations in swinging bells to notify people that locomotives were approaching, before railroad men thought of a better means of warning, it is easy to understand why welding did not replace riveting for fastening metal sheets and shapes together as soon as welding was perfected.

Water service facilities, except in tanks and tank stands, have employed few rivets. In fact, since wrought iron and steel pipe has been welded lengthwise from its inception, it was no great step to start welding pipe together section by section, or piece by piece, as soon as a suitable means was found for doing so. For that reason, welding in water service is far in advance of welding on bridges and buildings. Since the subject of welding in water service has been covered so thoroughly in papers and discussions before this association in the past, your committee will not at this time harrow ground that has already been planted, but rather will present a few novel practices.

Steel water tanks are subject to corrosion on the entire outside, and on the upper sections of the inside which may be alternately wet and dry. Of course, there may be water conditions which will corrode the entire inner surfaces. When cleaning corroded tanks for painting, it may be found that rivet heads are eaten off, that pits extend through or nearly through sheets, and that seams are weakened. Often the roof and roof members are badly eaten away. There have been cases of roofs collapsing and falling into tanks.

With welding, pits are filled and smoothed out; rivet heads are built up; seams are sealed and reinforced where necessary; roofs are repaired, or replaced if too far gone, and generally the tanks are made good for several more years at least.

Repairs to tank supports by welding follow the established practices for bridge welding. Work on ladders, spider plates and radius rods follow performances established for shop buildings and such structures. The make up of flanged slip joints and connections for piping through the bottoms of tanks can be all welded. The building up and repairing of tank valves for water tanks save critical material that is hard to secure and the welding of valve rods may save delays to putting water on locomotives.

New or inexperienced hostlers or firemen may uproot water columns, which must be gotten back into service within the least time possible to avoid serious delays. Welding will reclaim spouts, side rods, lock rods, bell cranks, brackets and fulcrum collars. Cast iron parts can be brazed.

For making quick changes of boilers at steam pumping plants, a greater part of the pipe connections can be welded together. In fitting up emergency water stations, welding overcomes many obstacles. Pipe welding is so well established for installing, renewing, repairing or maintaining pipes, connections, etc., wherever fluids are piped, that this feature of welding in water service will not be gone into.

Where welding or cutting is to be done in the vicinity of combustible material, special precautions should be taken to make certain that sparks or hot slag do not reach places where

fires may start. Wood floors should be covered with suitable non-combustible material where sparks or hot metal may fall. Cracks and open spaces should be sealed so that hot particles cannot enter.

Enough water should always be available to quench all embers quickly. It is safest to cease all welding and cutting operations in time to make sure no smouldering materials may break into a blaze in or around buildings or structures after the welding equipment has been put away.

Welding equipment and rods are perfected to a point where, with proper design and control, welding can be used with assurance in bridge, building and water service work on the railroads. Welding saves time, labor and material. In order that welding practices may be uniform within good and safe bounds, engineers should establish a code covering all phases of welding work for constructing, reconstructing, reinforcing and repairing steel members of bridges, buildings and water service structures. Until such a code is adopted, it is best to follow the guidance of well-established producers of welding supplies and appliances whenever important members of a structure are to be welded together.

Committee—G. S. Crites (chairman), div. engr., B. & O., Baltimore, Md.; Lem Adams (vice chairman), v. p., Oxweld Railroad Service Co., Chicago; G. H. Johnson (vice chairman), gen. fore. b. & b. & w. s., A. T. & S. F., Marceline, Mo.; F. C. Campbell, asst. ch. engr., E. J. & E., Joliet, Ill.; A. B. Chapman, br. engr., C. M. St. P. & P., Chicago; L. Clapper, asst. ch. engr., D. M. & I. R., Duluth, Minn.; A. R. Harris, asst. engr. br., C. & N. W., Chicago; C. R. Knowles, supt. w. s. (retired), I. C., Chicago; H. C. Larsen, str. iron fore., C. St. P. M. & O., St. Paul, Minn.; I. A. Moore, trmstr., C. & E. I., Salem, Ill.; J. E. Showalter, asst. engr., M. P., St. Louis, Mo.; F. R. Spofford, supvr., b. & b., B. & M., Boston, Mass.; I. F. Stern, cons. engr., Chicago; and T. M. Von Sprecken, engr. br., Sou., Cincinnati, Ohio.

B. & B. SECTION

Bridge Inspection in the Light of Current Restricted Maintenance

Report of Committee

H. M. HARLOW
Chairman

THE present restrictions on maintenance have made careful and thorough inspections of bridges more important today than during periods when materials and labor were more easily obtainable, although bridge inspections have always been of vital importance to the safe operation of trains and to economy in maintenance. Present restrictions have added to the duties of inspectors and inspection parties in that much regular maintenance work, which, in normal times, is done as a matter of routine, must now, of necessity, be postponed. The decision as to what work to defer is based upon inspection data. For this reason the inspector must consider carefully the defects found in structures and must decide which require immediate repairs and which can be held over, and how long. Superficial and inaccurate inspections can cause the waste of both man-power and materials, which might be better expended on other structures. They might also cause interferences with efficient operation by reason of failure to detect defects in time for correction. The greater train speeds and heavier volume of traffic of today can shorten the time between the initial development of a defect and a condition approaching failure of the structure.

A questionnaire designed to determine the practices of various railroads regarding the inspection of bridges was sent to a number of Class I roads, and the replies indicate that while there is a wide variation in the organizations and methods employed in making bridge inspections, the results sought and obtained are similar. The questionnaire developed that no definite special instructions have been issued to bridge inspectors by most roads because of current restrictions in materials and labor. In the opinion of most supervisory officers charged with inspection, such special instructions have not been necessary because standard instructions are considered sufficient. All replies, of course, indicated that maintenance programs are based upon the inspection data secured, and in a majority of cases it was reported that current restrictions were a large factor in determining the amount of maintenance work to be done and the methods to be employed.

Practically all replies stated that inspectors and those division officers responsible for bridge maintenance were kept informed of those changes in current material restrictions which would affect this class of work. With the availability of various materials constantly changing, this is highly important. For example, the availability of sawed timbers may determine whether a pile trestle should be repaired with piles or renewed as a frame trestle, and the availability of reinforcing steel may determine whether a stone abutment or pier requiring repairs should be encased or repaired with plain concrete. The availability of the various materials will also affect the amount of labor to be expended. If one type of material is available, the labor costs on a repair job may be much lower than if other materials are used, and thus precious man-power may be conserved for work on other structures. For this reason, as well as others, it is important that all concerned be kept advised of changes in material restrictions.

Some practices adopted by various roads because of present shortages in labor and materials include the contracting of some work formerly done by company forces; the in-

creased use of power tools; more extensive use of non-critical materials; welding to reinforce light steel bridges, rather than replace them; more careful consideration to the use of salvaged steel spans; the turning over of stringers, rather than their replacement with new timbers; and closer check of the decks of steel bridges. Inspection is important in determining the feasibility of carrying out these practices.

Painting Programs

Practically all roads contacted still maintain painting programs for steel bridges. Proper inspection will do much to insure that structures needing paint will be protected, and that those which can be carried for a while are not included in the current program. The spot painting of structures is economical when the bridge is large enough and when the need for paint on certain parts of the bridge is much greater than on other parts. Proper inspection and judgment are necessary to determine the economy of spot painting, but where this type of painting can be done, it will save much labor. It is not at all certain how long present labor and material shortages will exist, and to delay the painting of a structure a year or two beyond when it could be done with minimum cleaning costs, will increase these costs out of proportion to the time of delay. The spot application of protective coatings at the time other work is done on a bridge can, in some cases, eliminate the necessity for moving a painting force to the bridge in the immediate future. Inspection can develop the necessity for such work, and proper supervision will insure its accomplishment.

The repair of masonry structures by pointing up joints, etc., involves few, if any, critical materials, and is desirable because, by such routine repairs the need for heavy masonry repairs can be prevented or postponed for many years. This is an economy item in maintenance, rather than one which involves improved operating efficiency, but sight must not be lost of the need to look beyond the immediate future of bridge maintenance. On some roads the material supply is much more acute than the labor supply, and such work as masonry pointing will make good use of the labor available when critical materials are not to be had in the quantities desired or needed to permit a proper balance of work between labor and materials. This is work that can be contracted satisfactorily to outside concerns, and it will pay large dividends in the future if handled properly. If labor is not available in the regular maintenance forces, the use of contract forces should be considered. The inspector must use good judgment in determining his recommendation for such work.

Great Confidence in Inspectors

A large majority of the roads contacted have not made more than usual repairs to pile or frame trestles, and have not as yet been forced to carry them longer than usual. This is due, no doubt, to the fact that these roads have maintained their structures in accordance with well-planned programs, and reflects credit on the manner in which their inspection work was carried out in the years immediately preceding the war. If current restrictions remain in effect for a few more years, preventing out-of-face renewals, a heavy load will be placed upon the shoulders of the inspector to insure that proper repairing and patching are done to keep their structures safe for operation. It is very likely that more repairing and patching will be done in the next year or two than in former years.

About two-thirds of the roads responding stated that they sometimes place reinforcing stringers in timber trestles, using second-hand material, rather than renew the stringers out-of-face. Two roads reported that new stringers were sometimes used as reinforcing stringers. To determine the practicability of such work, close inspection of the existing structure must be made. The inspector, if possible, must determine if the existing stringers have sufficient life left in them to make reinforcing stringers effective in carrying the structure long enough to justify the cost involved. Of course, if safety of the structure is involved, economy will not be the prime factor to consider.

All roads reported that second-hand ties, caps, timbers, etc., are salvaged from structures and are reused. If too large a quantity of second-hand material is secured from a rebuilt structure, it may indicate that inspection was not as close as it should have been and that critical supplies of labor and material were used which could have been saved by repairing the structure. Proper inspection could have prevented this waste.

The replies of the roads were about evenly divided as to whether structures are being carried to a greater stage of deterioration than usual. About half of the roads reporting that they now carry structures longer than usual, stated that this is being done because of lack of material. The fact that these roads carry their structures longer indicates that confidence is placed in the responsibility of their inspectors. It is the duty of the inspector to see that this confidence is justified.

Safety, Most Important

All roads reporting stated that an attempt is made to keep bolts, lag screws and other fastenings tight. This is an important item in obtaining the maximum life from materials, and the need for this work can be established only by the inspector. The prevention of premature failures of timbers because of loose fastenings can be prevented by careful inspection and proper maintenance.

About half of the roads replying stated that more frequent inspections have been necessary because of restricted maintenance, while the others stated that they have not found this necessary. In all cases, the regular personnel has been able to do what additional work has been required. This indicates that the inspection organizations on the various roads have been adequate generally to take care of the present situation, even though requirements have increased the amount of work in some cases.

The assignments of inspectors vary widely during the winter months, running from office work to regular inspection work, depending largely on the section of the country through which the road operates. The authority of the inspector to rule on regular maintenance program work varies, but is limited generally to recommendations to higher maintenance officers.

With conditions existing on the railroads today more severe than ever before, it is important that all inspectors be mindful that more care than ever is needed to keep structures safe. Traffic is denser, speeds are much greater, equipment is heavier and the maintenance forces and materials are not available in quantities proportionate to the depreciation of structures. Individual conditions as they arise must be met promptly and the proper maintenance procedure must be decided upon as the occasion demands. It is very difficult at present to program maintenance work in advance, as the means necessary to carry it out cannot be depended upon because of changing restrictions. It is, therefore, up to inspectors and supervisors to exercise all of the judgment

and ingenuity that they possess to meet the requirements of maintaining their structure in proper condition.

A cut and dried set of instructions to inspectors to meet present conditions is not necessary. However, at the Forty-Second Annual Meeting of this association in October, 1935, a report was presented on "Inspection of Bridges and Buildings in the Light of Today's Deferred Maintenance," which contains a typical set of instructions to inspectors. The first of these instructions is still extremely applicable in the light of today's problems. It reads as follows: "Safety is the first consideration—then economy."

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B. & B. SECTION

New Possibilities in Building Designs and Materials

Report of Committee

W. A. HUCKSTEP
Chairman

NOTWITHSTANDING the severe war-time restrictions that have been imposed upon the many critical materials that are so closely associated with building construction, there are many evidences that the post-war period will see an almost unparalleled wave of railway building construction and rehabilitation. Already, the plans of many individual railways are well advanced for the extensive modernization of present methods of handling passenger and freight traffic, and, as a whole, they are planning to exert every influence and to use every method to retain as large a part as possible of the record-breaking traffic they are now handling.

Recognizing the potentialities of the competition with which they will be confronted after the war, the railways are now planning to combat such competition with faster and better service. These plans call for the extensive procurement of new equipment—modern locomotives, streamlined passenger trains, and the latest developments designed to speed the delivery of freight.

Building construction and modernization comprise no small part of these general plans. Foremost in these considerations are passenger stations, freight stations and other buildings where railway representatives meet and transact business with the general public; terminal buildings; and shop facilities, particularly to provide facilities adapted to the maintenance and servicing of Diesel locomotives. And even roadway buildings will come in for their share of attention and modernization.

Equally as important in the over-all picture will be the new developments in materials that will be available to railway architects and engineers after the war. Driven by the lash of war and the necessity for production that a few years ago would have been considered fantastic, American science and industry have attained new heights of achievement during the last two or three years. Today's outstanding developments in metals and their alloys, in synthetic rubber, in electrical apparatus and lights, in glass, wood fabrication, synthetics, cements, asphalt, asbestos and gypsum, give but a hint of what may be expected in new and improved railway materials in the post-war period. In addition, other improvements, including new ways of forming, shaping, joining and bonding lumber; extensive developments in plywood, asbestos-cement siding, glass, asphalt and gypsum products, all designed for better and more efficient building construction, will be available after the war.

Aluminum and Plastics

Although the present tremendous capacity for producing aluminum is being used almost in its entirety for military applications, there will be more aluminum available after the war for railway, industrial and general use than at any time in the metal's history. Among the developments of the aluminum research laboratories for military use are many that promise to be useful to the railways in the post-war period.

Although the application of aluminum to building architecture dates back about thirteen years, this field has been barely touched. Some of the more dramatic applications to date include the spandrels of skyscrapers, decorative statuary, and molding and trim, but there are many other applications awaiting development. By virtue of its resistance to the elements and corrosion, the use of aluminum for window sash and frames may be extended to plain and corrugated siding and roofing. Aluminum paint, by reason of its durability and light-reflecting qualities, has been used to a large extent throughout industry as a protective coating, and its use as a prime coat for wood was just getting under way on a broad scale before the war. All of these applications will be renewed and expanded in the post-war period.

Amazing results have come from the war-time developments in plastics, particularly in the aeronautical field, where their most spectacular use has been for structural members for

planes. A partial list of the additional successful applications of plastics to war planes includes control wheels, handles, seats, floors, window frames, trim tabs, pulleys and pulley brackets, ammunition boxes and chutes, electrical apparatus, landing wheels and fuel tanks—all, in themselves, indices of what may be expected from plastics after the war. Introduced primarily as a substitute for the critical metals, plastic pipe and tubing already provide many of the desirable characteristics of metal pipe, in addition to possessing valuable properties uncommon to metal tubing. The new plastic tubing, available with threaded joints and easily welded, is approximately one-quarter the weight of steel pipe in corresponding sizes. Furthermore, it has a high degree of chemical resistance and is unaffected by commercial acids and alkalies. Oil, gas and water can be carried with no apparent ill effects to the liquid or the tubing. The new material, however, is not adapted to severe freezing or to temperatures above 170 deg. F.

Today, plastic casings for electric hand tools and plastic hardware are making possible the production of these necessary tools and building appurtenances, while releasing critical metals for war purposes. Tomorrow, plastic casings may mean tools of lighter weight, resulting in more power per pound, easier handling and better performance. Tomorrow, plastic hardware may mean lustrous hardware for stations and office buildings; economical hardware, for it will be mass molded without the need of tedious machining, polishing or lacquering; colorful hardware, because the color will be an integral part of the material and will not wear off, with a finish that will not corrode or require polishing.

New Possibilities for Lumber

The lumber mills and modern wood fabricating plants of the country afford possibilities for a new conception of engineering in lumber. New ways of forming and shaping lumber, the broad expansion in the use of timber connectors, the development of new glues and bonding methods, extensive developments in plywood, the effectiveness of fire-retardant treatment, and many other new developments which have been pressed into war service to speed erection and to conserve critical materials, are certain to retain many of their applications after the war, and doubtless will be expanded to many new uses. By reason of its immunity to corrosion, the fact that, pound for pound, it is stronger than steel, and the further fact that it can be built up into members of almost any size and shape within specific limits, laminated wood construction may well prove adapted for roof trusses, arches, rafters, beams and other structural members in shops, trainsheds, stations and other railway structures.

Developments in plywood, employing phenol resin cements and bonding by means of high-frequency electrostatic heat treatment, have produced an amazing new material that has undergone grueling tests in the wings of the Mosquito bomber. The phenol resin finish is as smooth as glass, and blow-torch tests, which required only 12 seconds to burn through ½-in. steel plates, required 39 seconds to penetrate the new resin-finished laminated wood product of the same thickness. Moreover, the tests did not set the wooden panel afire, even though it had not been given any special fireproof treatment. Made of hot-plated and heat-treated phenol resins, plywood shipping cases, highly resistant to termite and fungus attack, have been used for protecting consignments to our military forces in the tropics, and reports show that for months these have withstood the termite attacks and rigors of a climate that destroys ordinary cases within a comparatively short period.

These and other new plywoods and molded wood products, many scarcely out of the test tube of American science, offer extensive possibilities on the railways in the post-war period. Whether the most important of these uses will be as siding and sheathing for freight cars, or for the interior finish of passenger cars, stations and office buildings, is yet too early to predict. However, their many outstanding physical characteristics, the fact that they can be made to order to meet innumerable engineering requirements, and that they lend themselves to a broad diversity of decorative treatment, place them unmistakably within the category of those new products that are certain to play an important part in the continued development of rail transportation after the war.

Lighting and Air Conditioning

As the result of consistent research and development, fluorescent lamps (introduced in 1938) now last 66 per cent longer and are nearly 34 per cent brighter than originally. Consistent and substantial price reductions in these lamps now provide more value for the lamp dollar, while actual case histories in war plants point to many advantages in this form of lighting. In one machine shop, after the changeover to fluorescent lighting, output increased 5 per cent, accidents fell off 50 per cent, and 25 per cent less scrap resulted from plant operations. Results in office work are equally interesting, showing 10 per cent less holdover work and fewer errors in typing.

Out of the clash of modern war have also come new developments in air conditioning, originally conceived in terms of temperature only, but followed by the controlled movement of air, the precise control of humidity, and the exclusion of dust. To these, the war has added the control of air pressure, a feature required for the testing of men and equipment under conditions imposed by stratosphere flying. Today, air conditioning can reproduce a wide range of climates, varying from the frigid cold of the polar regions to the parched heat of the desert, and with equipment that is more flexible and more compact than ever before.

The war has also given tremendous impetus to the development of many materials as substitutes for critical materials. For example, progressive improvements have been made in glass blocks, as an insulating and light-transmitting material for building construction. Plastic fly screens that are strong and do not corrode are already on the market, while plastic bathtubs, and floors that look like wood, yet do not require polishing, are on the way. Many other improvements in materials, born of the war, have not been disclosed and will not be available until after the cessation of hostilities.

Although the war-time scarcity of building materials has been largely responsible for the severe retrenchment in building construction in recent years, it has also brought about other developments. In some instances, the enforced use of so-called substitute materials has brought about a clearer realization of the possibilities of modern materials and their adaptability to modern design.

Large Architectural Opportunities

Railway buildings offer large architectural opportunities, principally because they have been neglected for so long a period. Among the problems now confronting railway managements is the disposition of so-called "monumental mausoleums," with their high carrying charges, that have been inherited from the past. The small Victorian depots with their dim lights, hard benches, pot-bellied stoves, peeling paint, unsightly interiors and outmoded facilities for handling passenger and freight business, present another very real problem. In general, the cost of renovating or rebuilding stations

should be considered in the light of promoting public good will, and of retaining a considerable proportion of the traffic gained during the war. Again, it should be measured against the direct gains and savings which arise from more efficient train and terminal operations, and the reduction of inflated carrying charges on older, oversize stations.

The three principal reasons for the major changes in station planning are: (1) The changed tempo of modern life; (2) longer trains; and (3) the higher architectural standards of modern public utility and other public buildings that have been designed for the convenience of the public, for the more expeditious transaction of business, and to provide more pleasing surroundings.

The faster tempo of modern life calls for stations in which all facilities can be quickly found and reached. Of all considerations, this is possibly the most important. Proper lines or lanes of circulation through, within and out of passenger stations should be given prime consideration in the planning of these new structures. It is most important that upon entering a station the route to ticket windows, baggage checking and train gates be as direct as possible. Access to toilet facilities, lounge, waiting room, lunch room and other services should be secondary to the principal flow of traffic. In localities where connections are made with airlines and bus lines, consideration should be given to the provision of facilities to accommodate transferring passengers with the least inconvenience possible.

Waiting room areas, where possible, should be planned as quiet reservations off to one side of the principal lanes of travel. Parcel checking lockers for smaller baggage should be distributed liberally about the station, rather than be bunched, and these units should be recessed within the walls. Informal lounge furniture, though more expensive to maintain, makes the station a more inviting place to meet friends, and obstructs the floor areas less than settees. Where stations are amply policed, upholstered furniture is desirable. Facilities for women should include powder and rest rooms. The powder room should be furnished with mirrors and tables. The rest room should be equipped with informal lounge furniture, and the floor may be covered with a carpet or other suitable material, such as asphalt tile, terrazzo, linoleum, etc. An added necessary feature in larger stations is a separate room for mothers with infants, affording facilities for feeding and changing in privacy.

Probably no other station facility offers so large an opportunity for major improvement as toilet rooms. Floors should be of impervious material, preferably ceramic tile. Glazed tile cove base is both sanitary and effective. Side walls and ceilings may be treated effectively with various materials, such as tiles, glass, and gypsum and asbestos products in various colors and patterns. It is suggested that the wainscots in toilet rooms extend to a height of seven feet to discourage vandalism.

Ticket offices should be of the open-counter type, wherever practicable. The days of the closed-in ticket office, with the windows open only at train time, are past, except in a few rare instances. Today, the traveling public must be served at all times if the railroads are to meet the competition of other forms of transportation.

For the most part the lighting standards of railroad stations are far behind those of other public buildings. In the past, not enough thought has been given to the lighting in waiting rooms, with the result that patrons frequently find it difficult to read timetables. Formerly, general practice provided two to four foot-candles in these rooms. Modern stations should have from 10 to 15 foot-candles of illumination in all parts of the station, with the exception of the train platforms. The use of fluorescent lighting should definitely be considered wherever lighting fixtures of that type can be utilized. The lighting of train platforms should be planned in consultation with operating officials to eliminate any real or fancied glare in the face of enginemen handling trains in or out of the station.

Station heating is an important consideration, and there are many types of central heating systems and various types of temperature control available from which the architect can select those best suited to the particular conditions involved. Some consideration might be given to radiant heating, with the pipes placed in the floors, walls and ceilings. The insulation of walls and ceilings is important in order to conserve fuel, to increase heating efficiency in winter and to afford better control of summer temperatures within the building, particularly if air-conditioned. In the post-war period, the air-conditioning of many railway buildings designed to serve the general public will be imperative if competition is to be met.

Great strides have been made in the acoustical treatment of buildings. Such treatment, of both the ceilings and the sidewalls, can play an important part in creating an air of unhurried quiet, even in a large crowded station. Acoustical treatment is also an important factor in providing proper acoustics for the public address systems that are replacing the old station callers, and the two problems should be closely co-ordinated for good results.

B. & B. SECTION

Enginehouses and Shop Buildings

The importance of enginehouses and shop buildings is well illustrated by the fact that fully one-quarter of total railway building expenditures, both capital and maintenance, is spent on these structures. Restricted expenditures in this field were pronounced during the eight years preceding the outbreak of war, even more severe than for station buildings, with reductions of 77 per cent in capital expenditures and 55 per cent for maintenance. The general situation also has been aggravated by the war-time scarcity of materials and the restrictions imposed on building construction.

It is significant, however, that even prior to the outbreak of the war, several of the more successful railways, measured by the yardstick of low operating costs, had revamped their locomotive and shop facilities to meet modern requirements. On these roads, extensive programs of new construction and modernization were carried out, together with the installation of modern equipment for servicing and maintaining rolling stock.

During the last 20 years the average tractive power of all locomotives in the United States has increased approximately 48 per cent, accompanied by corresponding increases in the size and weight of locomotives and tenders. Obviously, under these circumstances, efficiency and economy of operation and maintenance are not fostered by the use of enginehouses, shops and equipment built or installed more than twenty-five years ago. Just as progress in freight and passenger service in recent years has created a demand for streamlined passenger stations and more efficient freight facilities, so it is exerting a profound influence upon shop and enginehouse accommodations, an influence that must be recognized through the design of structures adapted to more efficient utilization and operation.

One of the outstanding developments in this latter regard is the new type of shop facilities being called for for the running, maintenance and heavy repair of Diesel-electric locomotives, both road and switching. This may call for new

shop buildings in many cases, or for the adaptation of existing shop buildings, but in either case it demands facilities designed specifically to meet the requirements of this newer type of power, in the interest of efficient shop operations and minimum shopping time. Already, more than 11 roads are planning new Diesel maintenance shops, and several of these shops are already completed or are nearing completion.

Outstanding requirements of these shops are that they must provide for adequate, no-shadow, day and night lighting, uniform heating during the winter months, adequate exhaust systems to carry off engine gases, and general cleanliness throughout, together with special arrangements of pits, floors and platforms to facilitate shop operations.

In buildings generally, where sulphuric gases are not present, roofs may be constructed with steel trusses and purlins, decked with precast Portland cement slabs or gypsum plank, and covered with built-up roofing. Corrugated asbestos roofing material is available for roofs of steeper pitch, and special types of asbestos roof decking are available for what are commonly referred to as flat roofs, or those having only a slight pitch. On roofs having a pitch of 4 in. or more per foot, asbestos shingles will prove durable and satisfactory, and may be particularly desirable where appearance is a prime consideration.

In enginehouses, machine shops, storehouses and other engine terminal buildings, dense, plain concrete floor slabs of varying thickness have been satisfactorily used during the wartime emergency in lieu of wood plank or wood block. Concrete foundations and brick masonry walls have been substituted for wood construction, with steel or reinforced concrete lintels spanning large door and window openings, and with brick arch construction in place of lintels for the smaller openings. Except in enginehouses, steel or reinforced concrete columns can be substituted for wood. Glass blocks are now being used to a considerable extent in enginehouse and machine shop construction, in place of steel and wood sash. Fabric-reinforced asbestos edging and flashing, with asbestos cap flashing, are now used extensively in built-up roofings in place of metal flashings and have proved satisfactory. Fibre conduit pipe, asbestos vent pipe, and even vitrified clay pipe are being used to replace cast iron or other metal downspouts. Some railroads have used second-hand boiler flues, flared at one end, for downspouts. Engine pits built of plain concrete, with short sawed track ties set therein and secured by anchor bolts with countersunk nuts, have proved satisfactory.

Circular or semi-circular wash fountains should be considered for shop washrooms, for these are being used by a number of railroads with good results. When new heating systems are to be installed or existing ones are to be replaced in shop buildings, consideration should be given to the use of unit heaters of ample size, because this method of heating has proved to be the most satisfactory in many railroad shops.

Prefabricated Roadway Buildings

Smaller roadway buildings, such as tool houses, motor car houses, pump houses, etc., which, in the past, have been built in place of conventional frame construction, may give way, in part at least, to prefabricated structures. Typical of a number of materials for such structures are panels with an insulating core and veneered surfaces of asbestos wallboard. Due to the present critical shortage of boards and other dimension lumber, this insulating board, which has a low factor of heat transmission, supplies an excellent panel-type material for use in smaller structures. An added value of prefabricated smaller structures is that they can be dismantled and moved readily, with little loss or damage, where changes in conditions require moves.

Today, the railroads have the money necessary to make needed improvements to many of their structures. Therefore, insofar as it is possible to do so with materials now available, the committee is of the opinion that this class of work should be done. Unfortunately, past experience has shown that when materials and labor are plentiful, money generally is not. Realizing this situation, the Interstate Commerce Commission is permitting the railroads to set aside fixed sums of money during each of the current war years for that part of current maintenance work which must be deferred because of the lack of materials or labor, thereby setting up funds to take care of this work in subsequent years. Now is the time for the railroads to start planning, not only for new stations and other types of buildings where public business is transacted, but also for the modernization and rehabilitation of existing buildings, in order that they will be able to meet the certain intensive competition from other forms of public transportation in the post-war era.

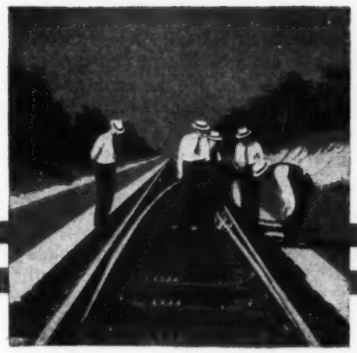
W. A. Huckstep (chairman), gen. bldg. supvr. M.P., St. Louis, Mo.; F. W. Dayton (vice chairman), arch. drafts., C. & N.W., Chicago; J. R. Burkey, cost. engr., Union Metal Mfg. Co., Canton, Ohio; C. M. Burpee, P. & S. ed., Railway Age, and ed., Railway engineering and Maintenance Cyclopedia, Chicago; P. B. Collier, b. & b. supvr., M.P., St. Louis, Mo.; K. E. Hornung, arch. drafts., C.M.St.P. & P., Chicago; L. E. Peyser, prin. asst. arch., S.P., San Francisco, Cal.; J. F. Redmond, supvr. str., N.Y.C., New York; S. R. Thurman, asst. b. & b. supvr., M.P., Nevada, Mo.; J. S. Vreeland, east. ed., *Railway Engineering & Maintenance*, and east. eng. ed., Railway Age, New York; L. C. Winkelhaus, arch. engr., C. & N.W., Chicago.

B. & B. Supply Men's Association

BECAUSE of the restricted character of the meeting of the American Railway Bridge and Building Association this year, as well as of the impact of war conditions upon the supply industry, the Bridge and Building Supply Men's Association, for the third consecutive year, deemed it impracticable to present an exhibit of the products of its member companies in conjunction with the one-day meeting of the Bridge and Building Association. In fact, because of the restricted attendance and the intensive program, such an exhibit would have been of little benefit to either the association or to the members who were able to attend the meeting.

Furthermore, because of the severe demands that are being made on these companies for materials needed for the prosecution of the war, it is doubtful whether they could have prepared an exhibit on a scale or of a value comparable to those that have been presented in previous years.

The officers of the Bridge and Building Supply Men's Association, who have carried on its activities since the last exhibit, two years ago, and who have been retained in office for the coming year are: President, R. Y. Barham, Armco Railroad Sales Company, Inc., Chicago; vice-president, F. A. McGonigle, Mall Tool Co., Chicago; secretary, P. R. Austin, Johns-Manville Sales Corporation, Chicago; treasurer, W. Lyle McDaniel, Massey Concrete Products Company, Chicago; and the following directors: P. R. Austin (also secretary); F. A. McGonigle (also vice-president); E. C. Bleam, Joseph Dixon Crucible Company, Chicago; A. C. Thomas, Overhead Door Company of Illinois, Chicago; G. B. Coffey, A. M. Byers Company, Chicago; E. C. Gunther, Duff-Norton Manufacturing Company, Chicago; and C. C. Rausch (honorary director) Dearborn Chemical Co., Chicago.



What's the ANSWER?

Flangeway Fillers for Crossings

Under what conditions are flangeway fillers desirable for plank crossings? Under what conditions are they not desirable? Why? How should they be installed?

Does Not Favor Them

By F. R. Layng
Chief Engineer, Bessemer & Lake Erie, Greenville, Pa.

Our standard grade crossing is constructed of treated black-gum plank, fastened securely to the track ties with lag screws, which are of a thickness equal to the height of the rail. In our territory there are few horse-drawn vehicles, so that our crossings are designed without fillers. Our experience, covering a period of about ten years, with crossings of this type, has been very satisfactory, and we have had no accidents to the horse-drawn vehicles that are used in our territory.

The objection to fillers is that the flangeways fill up with materials dragged in by the highway traffic. This is particularly true on gravel roads and on roads that are scraped by those in charge of highway maintenance. To guard against this hazard, the highway crossing must be inspected frequently, and the maintenance operations on the highway itself must be watched by railway employees to insure that these operations do not create a dangerous condition as a result of filling the flangeways.

If fillers are not used, the danger of materials collecting in the flangeways to the extent of becoming dangerous to railway traffic will be considerably less. It is my belief that highway grade crossings without fillers are somewhat safer in the winter, as there is less likelihood of snow and ice packing in the flangeway. Our experience in not using fillers has been so satisfactory that we are convinced that for the conditions that exist in this territory, flangeway fillers are undesirable.

Should All Be Equipped

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

I believe that all crossings should be fitted with flangeway fillers. There is no reason of which I am aware, why plank crossings cannot be installed in such a manner that one of the planks on each side will fit under the head of the rail on the gage side. On the other hand, no flangeway material is required on the outside of the rail. These planks should be so designed and installed that if it becomes necessary to remove one or both of them, it will not be necessary to remove all of the planks in the crossing, or at least all of those inside the rails.

Rails in crossings are subject to more wear than those in open track, while they are frequently subject to considerable abuse also, largely because foremen dread to work through crossings and so are inclined to neglect them. Much work is involved in tearing out a crossing and maintaining traffic on the highway, while at the same time repairing or surfacing the track. Where flangeway fillers of the type mentioned are used, the ballast will remain clean, the planks can be removed for tamping and lining, and all of this will require only a small amount of work over similar repairs elsewhere. As a con-

Send your answers to any of the questions to the What's the Answer Editor. He will welcome also any questions you wish to have discussed.

To Be Answered in January

1. *What types of work equipment should be assigned permanently to a supervisor's district? To a division? What types should be considered regional or system equipment? Why?*
2. *What is the smallest building repair job on which it is feasible or economical to use power tools? Bridge repairs? What are the advantages? The disadvantages?*
3. *To what extent and in what ways can weed burners be used in fighting snow? Where? What are the advantages? The disadvantages?*
4. *In view of the existing labor shortage and the present volume of traffic, is it practical to carry on routine bridge work during the winter? What work? What precautions should be taken? Why?*
5. *In view of the present density of traffic and speed of trains, what is the most practical method for distributing ties? What other considerations govern?*
6. *To what extent is it necessary to heat pump houses where the pumps are under automatic operation? If heating is necessary, how can it be done?*
7. *Does the probability of sudden thaws during the winter or early spring warrant the opening of ditches where snow has been plowed from the track? Why?*
8. *Is wane a natural or a manufacturing defect? Warp? Skip? How do they affect the use of lumber?*

sequence, the track will be in better condition and will ride more smoothly.

If the flangeways are allowed to remain open, dirt and debris will accumulate, fouling the ballast, affecting the surface through the crossing, and sometimes packing so tightly in the flangeway and under the crossing that the plank will be forced upward. Likewise, since this accumulation tends to hold moisture, there is a greater tendency for the rail and fastenings to corrode.

Safety Factor Enough

By George Stafford
Section Foreman, Canadian National, Redland, Alta.

Safety, alone, is sufficient reason for equipping highway crossings at grade with flangeway fillers, since they reduce the hazard of the packed flangeway. The provision of a shallow channel in place of the open flangeway limits the amount of snow or debris that can accumulate below the top of the head of the running rail. Then the action of the wheel flanges working within the limited space tends to plow out any material that may have lodged in this space, so that to a large extent such flangeways are self-cleaning. This is true not only of snow and ice, but also of sand, dust and mud that may be carried into the crossing by highway traffic, dust storms or other causes.

The facility with which flangeways fitted with fillers can be kept clean, in contrast with those not so equipped, is reflected in the comparative labor costs. It is estimated that the savings effected in a single season in the cost of keeping the flangeways clean will more than offset the cost of the flangeway fillers. The chief reason for this is that the smooth surface of the filled flangeway offers no obstruction to the cleaning tool, whereas, the open flangeway is dotted with an assortment of rail fastenings, which makes thorough cleaning a protracted operation.

The second-hand-rail type of filler is best suited for plank crossings, whether the planks used are treated or untreated. Its cost is negligible when compared with the cost of most of the specialty fillers on the market; it is easy to install and imports stiffness to the whole assembly through the solid backing it provides for the inside plank sections. This type of flangeway prevents the penetration of snow and other materials and the consequent lifting of the planks, a hazard in a heavy snow country.

Bents for Trestles on Curves

When framing bents for timber trestles on curves, should the super-elevation be framed in the posts or formed in the bearing under the sill? Why? How should this be done?

There Are Two Types

By A. E. Bechtelheimer
Engineer of Bridges, Chicago & North Western, Chicago

In deciding this matter, consideration should be given to two types of support for the bents, namely, pile supports and masonry piers. For the former there are also two options, (a) cutting of the piles in a horizontal plane and erecting a frame bent thereon, with the posts framed under the caps to provide the desired super-elevation of the track; and (b) cutting the piles to correspond with the desired elevation. In the latter case, the sill and the cap will be parallel and the framing of the posts will be the same as if the trestle were on tangent, without super-elevation. From an erection standpoint (a) is more favorable than (b), because it is simpler to lay out a level cut-off than one on a bevel. After the straight edges are set, however, the actual sawing is the same in either case.

Likewise, when framing bents are to rest on masonry supports, we can make the top of the pier level and (c) taper the sill to conform to the super-elevation; or (d) use sills of uniform thickness, placing beveled separator blocks between the masonry and the sill to super-elevate the bents; or (e) we can use a sill of uniform thickness and frame the super-elevation in the posts. Scheme (c) requires an added expense for tapering the sill, but eliminates the use of separator blocks. Scheme (d) affords an advantage, in that the thickness of the separator blocks can be changed to adjust the super-elevation if this is required at any time in the future. There is also an advantage in (e), since this uses standard sizes of timber, and if treated sills are used, they eliminate the necessity for placing separator blocks under the sills. The foregoing applies particularly to a masonry pier of the monolithic type. Where the construction is of the pedestal type, the sill should be placed horizontally for simplicity of construction.

While the question makes no reference to any specific height of the framed bents, I assume that the reference is to bents of two or more stories. A well-designed bracing system is essential for high bents. This system makes the framed bents act as a truss, transmitting lateral forces to the footing, which must be anchored in the ground. I consider this the compelling reason why all sills should be level and why the super-elevation should be provided for at the top of the bent.

For these reasons, it is recommended that the super-elevation be framed in the posts under the cap, in order to have vertical posts to carry the vertical loads of trains moving at slow speeds. Frame bents must be braced adequately with both sway and longitudinal bracing, and caps must be anchored to the stringers, this procedure being in accordance with past practice, at least to the extent of my observation.

Frame in Posts

By General Inspector of Bridges

I am not in favor of designing a timber trestle that is on a curve with the caps and sills parallel and both corresponding to the super-elevation of the rails. Such a design might be satisfactory if all trains moved over the structure at a specified speed, and there was assurance that no train would be stopped on it. Such a design can be suitable for only one speed, this being the speed at which the resultant of the gravitational pull on the locomotive and cars and of the centrifugal force created by the given speed, will be normal to the plane of the rails and, therefore, to the cap. In other words, if the train runs at low speed or stops, there will be no vertical posts to support the load, and the forces acting on the bent tend to collapse it toward the inside of the curve.

It is true that bracing can be applied to resist and overcome this tendency toward collapse, but why create a design in which such a tendency must be overcome, when it is not necessary? It is true that the reverse will happen if the train runs at a higher speed than that assumed when selecting the super-elevation. But providing resistance to forces acting

toward the outside of the curve is an inherent part of the plan, so that no new element is introduced, there is no reason why the sill cannot be made level, with the super-elevation framed into the posts. The bents will be stable even if the line of the resultant passes on the outside of the center of gravity of the bent, but well within the outside posts, provided it is suitably braced to act as a unit when the force is applied. Care should be exercised, however, to insure that the design is such that the whole or a major part of the load will not be thrown into one or two posts in the bent.

When to Tighten Track Bolts

Is it more desirable to tighten bolts in the fall, the spring or at some other time? Why? Does the weight of the rail or the volume of traffic make any difference?

Best When Surfacing

By F. G. Campbell
Assistant Chief Engineer, Elgin, Joliet & Eastern, Joliet, Ill.

There may be a slight advantage in tightening bolts in the fall. I do not believe that such advantages are compelling, however. When bolts are tightened in the fall, they show a tendency to remain tight somewhat longer as a result of increasingly cold weather. However, probably one of the principal values of tightening bolts in the fall is that it can be done after such seasonal work as renewing ties and surfacing has been completed, so that it becomes a part of the general fall house cleaning. Regardless of the season, there is a decided advantage in tightening bolts at the time the track is being surfaced. This will decrease materially the number of low joints that will be found after the surfacing has been completed.

Neither the amount of traffic nor the weight of the rail will have any bearing on the season of the year in which the bolts should be tightened. On the other hand, the volume of traffic, the weight of rail and the type of joint bar will obviously have a material effect on the amount of tightening that will have to be done on track bolts.

Whenever They Are Loose

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

I am in favor of tightening bolts in the fall, before the temperature gets too low. In doing this the joint bars should be struck at the bottom with a hammer to bring them to a snug fit with the fishing surfaces of the rail. The bolts should then be tightened. They should be gone over again in the spring when the weather has moderated. Almost invariably at that time one will find some bolts that have loosened enough to require retightening. In fact, a good foreman will have his men tighten bolts any time they are found to be loose. Bolts tend to loosen more easily as they get older. This may be because of wear on the threads or wear on the fishing surfaces of the rail and the bars, or for other reasons. Formerly, it was necessary to include stretch as one of the causes of loose bolts, but the heat-treated bolts of the present do not take a permanent stretch under the loads that are applied to them.

Does the weight of the rail or the volume of traffic make any difference? It is more difficult to keep bolts tight on light rail, and this difficulty increases with the volume of traffic and train speeds. Even with the heavy rail sections in service today, all parts of the joint assembly are subject to wear and, obviously, this wear will increase with increased traffic, and wear tends to cause loose bolts. Whenever bolts get loose, they should be tightened, for loose bolts tend to wear on the component parts of the joint and to increase rail-end batter.

Repairing Power-Plant Chimneys

What repairs to a power-plant chimney are required most frequently? How should they be made? By whom? How should the chimney be inspected?

Mostly to Stop Leaks

By W. C. Harman
Supervisor Bridges and Buildings, Southern Pacific, San Francisco, Cal.

In general, power-plant chimneys are constructed of steel plates, brick or concrete, or a combination of two or more of these materials. The repairs needed most frequently to those of brick or concrete consist of sealing cracks in the wall which have been caused by expansion or settlement. Obviously, this must be done to prevent interference with the draft through the chimney, for such interference will affect the boiler.

In general, the procedure in making the repairs is to clean out and open the cracks enough to permit calking putty to be forced into them by means of a pressure gun or with putty knives. The putty used for this purpose is available on the market, but some power-house operators prefer to prepare their own mixtures. On the Southern Pacific, the power-house operator cares for all cracks that are within his reach, but those above the roof are cared for by the bridge and building forces.

Steel chimneys require more maintenance than repairs, that is, the inner surface is attacked by gases of combustion, while the outer surface is exposed to the weather and often to the corrosive effect of gas-laden air. In addition, while the outer surface must be protected with paint, the high temperature of the flue gases soon deteriorates the paint. For these reasons, it is necessary to clean and paint steel stacks at intervals of about six months.

This work is done by either company forces or a contractor. The surfaces are cleaned with wire brushes and scrapers, after which two coats of heat-resisting paint are applied. The chimneys are inspected by men assigned from the bridge and building department, using a boatswain's chair when necessary. However, the condition of steel chimneys can usually be seen in enough detail to determine when painting and repairs are necessary.

When a chimney has reached the stage that renewal is required, the fuel engineer is called in to decide whether the existing stack is adequate to handle the gases from the boilers. If he finds that it is not, he will design one to meet the requirements of the plant, and the bridge and building forces will install it. The change in dimensions may be made by increasing

the diameter or by extending the height, or by doing both.

When inspecting steel chimneys it is important to check carefully that part directly beneath the guy bands, for it is here that the steel is likely to rust out first, unless the bands have been welded to the stack. Recently we have eliminated these bands, using instead eye bolts, after first welding a reinforcing patch at each eye.

Repairs Are Simple

By General Inspector of Buildings

Chimneys for small power houses are generally steel stacks; those for the larger plants are now usually constructed of specially-designed radial brick. We have, however, a number of older chimneys that are built of common brick with a lining of fire brick for some distance above the entrance of the breeching. I have also seen a number of concrete chimneys. As a rule, the repairs to the steel and brick chimneys are simple in character, although they are not always easy to make.

Steel chimneys are subject to corrosion both inside and out, and the service life can be extended considerably if they are kept painted. The paint, however, must be of the heat-resisting type, since ordinary paints will burn off in a short time. None of our chimneys built of radial brick have required repairs, except where slight damage has occurred in replacing breeching, and occasional pointing.

In general, the trouble we have experienced with the chimneys constructed of common brick has been the formation of cracks which seem to dampen the draft. We go over these chimneys at intervals to point them, and at the same time we clean out any cracks that may be in evidence and fill them with calking putty, a product that is available on the market for this purpose. I have had no experience with concrete chimneys.

Dusting of Concrete Floors

In what ways can the dusting of concrete floors be overcome? How prevented in new floors?

Use Correct Methods

By Frank W. Capp
Structural Bureau, Portland Cement Association, Chicago

Dusting of concrete floors is usually *prima facie* evidence that one or more fundamental rules for constructing the floors has been violated. These rules include (1) only suitable materials should be used; (2) the use of not more than 4½ to 5 gal. of mixing water to a sack of cement, including the water introduced as surface moisture on the aggregates; (3) the use of mixtures and construction methods that will not permit segregation, resulting in free water and fine material on the top surface of the concrete; and (4) the prevention of early evaporation of water from the concrete by keeping it wet as long as practicable. Specifications incorporating these fundamental rules are readily available and it remains only for the user to follow them.

In some cases, although correct methods have been employed in constructing the floor, dusting takes place because the floor was not protected during subsequent construction operations. The newly finished surface becomes littered with plaster, mortar and concrete droppings, and these materials become ground into the floor surface. Then, when the floor is placed in service, the layer of waste pulverizes under traffic, causing dust.

If the floor has not been protected adequately during construction, it should be given a thorough cleaning. After sweeping with an ordinary broom to remove loose dirt, the surface should be wetted with soap suds and rubbed down with a scrubbing machine fitted with a wire brush or a pad of fine steel wool. The abrasive action of the brush or steel wool will remove the film of consolidated dirt and expose the true wearing surface. The floor should then be mopped to remove the loose dirt.

A final scrubbing should be given with soap suds and a fibre brush fitted into the head of the machine. A well-laid finish treated in this manner will not dust because all adherent dirt will have been removed. This treatment is also often effective in removing the thin layer of soft material that sometimes results from over-troweling concrete during the finishing operation.

If correct methods of construction have not been followed, the foregoing treatment may not be sufficient to prevent dusting, and it may be advisable to apply some material to assist in hardening and binding the surface. However, these treatments are not cure-alls for poor materials or careless workmanship. They will improve many surfaces, but they will not make a perfect wearing surface of a poorly-built floor. Magnesium fluosilicate, zinc fluosilicate, sodium silicate, aluminum sulphate, zinc sulphate and various oils, gums, resins and paraffins are substances used for this purpose, in addition to which a large number of proprietary hardening materials are available.

Dusting Unnecessary

By General Inspector of Buildings

Concrete floors and concrete platforms that do not dust can be built, and if such a floor or platform does dust, it is certain that poor workmanship, poor materials or both are at fault, and that the responsibility for the failure of the construction to stand up under use must rest upon the person who had charge of the work. No one should ever be allowed to do careless work in constructing a floor, with the idea that careless or poor workmanship can be offset later by the application of an artificial floor hardener.

One of the essentials of a concrete floor that will resist abrasion and consequent dusting is that the aggregate used in the concrete mix shall be hard and abrasion resistant. The large aggregate should not contain any fine material, should be not more than ½ in. maximum, and should be well graded. The mixture should be neither lean nor wet; in fact, it should be quite stiff when placed and reasonably rich. It should be leveled off and screeded to the correct level as soon as placed; it should be allowed to harden for a time, until neither fine material nor water will flush to the surface under troweling, and should then be troweled to a smooth finish. If troweled too soon, water and fines from the mortar will rise to the top, with the result that dusting is almost certain to ensue.

Curing is of equal importance with mixing and placing. After the surface has hardened sufficiently, so that the water will not erode it, this can be done by keeping it well flushed with clean water. If this is not practical, the surface can be covered with a layer of sand or shavings, and this material can be kept well dampened. The curing process should be continued for

at least a week. It is desirable to construct concrete floors during mild weather, but if they must be constructed during periods of low temperatures, they should be fully protected against the cold, during both the constructing and curing periods. Otherwise the results will be poor.

Off-Season Use of Machines

To what extent and in what ways can seasonal power machines and power tools be used in off-season work? What machines? What are the advantages? The disadvantages?

Names Several Machines

By Supervisor of Work Equipment

Rail-mounted air compressors that are used during the summer with tie-tamping outfits for tamping track on resurfacing and reballasting jobs, can be placed at strategic points in large yards and elsewhere to be used in blowing snow from switches, and for breaking up ice with the tamping tools after they have been equipped with chisel points.

Tractor snow plows, used primarily for plowing snow around terminals and on station platforms, can be used during the summer months for hauling trailers equipped with platform and dump bodies to transport track material, to haul dirt and refuse to dumps and for other similar tasks.

Combination crawler-mounted overhead loaders and bulldozers can be used during the summer for bulldozing and leveling building sites, grading, and for loading dirt, cinders and other material, and during the winter for plowing and loading snow around terminals, freight houses, driveways and elsewhere where accumulations of snow must be moved.

Generators for electric tie-tamping tools, used normally for tamping ties during the summer, have many other uses, such as providing power for lighting where work must be performed at night, and for operating a wide variety of electric tools. Weed burners, can be used for melting snow around slip switches, interlockings and car retarders.

Spreader-ditchers are used during the summer for ditching, bank widening, and plowing and spreading, but they can be used to equal advantage in yards during the winter for spreading snow off several tracks to accumulate it on one or two tracks for loading. This equipment can also be used on main tracks as a snow plow, if suitably equipped, and for widening cuts into which snow has drifted.

Thirty and forty-yard air-dump cars, used normally for hauling and dumping rip rap, gravel, cinders and other loose materials can be employed for hauling snow from congested places from which it must be removed. Again, clamshell buckets can be converted into large capacity snow buckets for loading the snow.

Heavy-duty motor cars with removable attachments can be used for discing and weeding during the summer and as heavy-duty cars in the winter. These cars can also be equipped with light V-plows and used for clearing industrial tracks and sidings of snow.

Much Theory, Little Done

By District Engineer

While there has been much theorizing with respect to the advantages of using seasonal work equipment for off-season work, unfortunately, little has been actually accomplished along this line compared with the possibilities. This is not because there are any inherent difficulties in such use, but either because maintenance officers have not recognized the possibilities inherent in getting the maximum practicable use out of power equipment, or they have not possessed the initiative to pioneer in a new practice.

If we undertake to list the seasonal equipment that can be used for purposes other than those for which the several types were designed, we immediately discover a number that are adapted for other uses. Among these are tie tampers, weed burners, paint-spraying outfits, ditchers, tractors, welding outfits and others. Air compressors and generators employed in tie-tamping outfits can be used for the operation of other power tools regardless of the season, and the generators can be used for lighting night work.

One road has used weed burners for keeping switches and car retarders clear of snow for a number of years. It has been reported that one of the large units will do as much as 80 men in a bad storm. One writer has said that scheduling the work rather than the machines will keep the machines at work the largest possible number of days during the year. He listed nine types of work equipment with a potential off-season working time of from 91 to 152 days a year. This schedule allowed 30 days a year for overhauling the larger machines, and corresponding periods for the smaller units.

The work each machine will do in or out of season should be classified and a comprehensive schedule prepared and adhered to as closely as possible. The geographical location of the work should be considered, if the greatest possible use is to be obtained from the use of work equipment. Weed-destroying equipment offers an excellent example of this, for all too often the burning, mowing or chemical treatment of the weeds is based upon a predetermined time, rather than upon climatic conditions and upon the growth of the weeds. Careful scheduling of the work to coincide with the weed growth will result not only in better weed control but also in obtaining much more use of the machine than where the schedule calls for starting the operation at a specified time, regardless of the progress in growth of the weeds.

Of equal or greater importance in the off-season use of power machines and tools is that they be kept in service both during the normal working season and the off-season period, allowing adequate time, however, for regular overhauling. It is an unfortunate fact that power machines and tools are sometimes allowed to remain idle because there is no immediate need for them on the particular district upon which they happen to be assigned. Such machines should be reassigned to districts where they are needed, particularly at present when equipment is needed so desperately to offset the labor shortage.

Daily or weekly reports which include every unit of equipment, except regularly assigned motor cars, will show whether any of these units are being allowed to remain idle when they should be at work. In one instance that came to my attention recently, a power ballaster and a large weed burner were allowed to remain idle throughout the summer of 1944, although the road that owned them was suffering from a serious shortage of track labor. In this case, in addition to suffering an economic loss through allowing two expensive machines to remain idle, there was a potential loss of labor amounting to

approximately 6,000 man-days. This neglect can be traced to either a lack of interest on the part of the supervisory officers involved or to failure on their part to appreciate the value of the equipment in saving labor, or rather in offsetting the lack of labor from which they were suffering.

How to Lay a Pipe Line

Should a pipe line be laid to a uniform gradient? What are the advantages? The disadvantages? Does this differ for gravity, suction and discharge lines? Why?

Not Entirely Necessary

By E. M. Grime
Engineer of Water Service, Northern Pacific, St. Paul, Minn.

While it is desirable to lay a pipe line as nearly to a uniform grade as the ground conditions make it feasible to do so, this is not entirely necessary. Long easy swings in the gradient make little difference, but abrupt changes may cause gas or air to accumulate in pockets at high spots, which will interfere seriously with the flow of the water.

A water-supply installation to a stock yard is recalled in which there was about 1,000 ft. of 2-in. pipe laid across a newly-constructed railway yard. The water was supplied from an elevated tank, with a head of about 10 ft. After this supply had been in use for a few months the flow became unsatisfactory. It became intermittent to the extent that after about one pail of water had come through the line, the flow would stop and then a small amount of water with a large volume of air would be discharged. This might be repeated for about five minutes, then there would be a steady flow for a minute or two, after which the pipe would again spout air with small quantities of water. It was quite evident that the pipe had settled so unevenly in the soft fill that air pockets were accumulating at various high points and causing this intermittent flow, and that the only remedy was to relay the pipe line.

Where the grades are such as to bring the pipe line to a rather sharp peak, and particularly where this peak extends above the hydraulic gradient, which is a straight line between the head on the pump or source and the discharge outlet, air may accumulate seriously to retard the flow and correction by an automatic air-relief valve may become necessary.

The foregoing refers particularly to a pump discharge line or a gravity-flow line. For a pump suction, the pipe should be laid with care to insure that there are no high points where air can accumulate. All air flowing with the water should be released at the high point on the line, which is usually at the top of the pump, particularly if it is of the centrifugal type. The suction pipe line should have a larger diameter than the pump suction opening, and it is important that the difference in diameter of the suction pipe and the pump opening be taken care of by an eccentric reducer, so placed as to avoid an air pocket near the pump.

Of Little Importance

By C. R. Knowles
Superintendent Water Service (Retired), Illinois Central, Chicago

It is of comparatively little importance, within reasonable limits, whether a discharge or pressure pipe line is laid to a uniform gradient or to correspond with the ground surface. Obviously, however, it is desirable that any pipe line be laid as near to the hydraulic grade line as practicable, in this case the hydraulic grade line being defined as a straight line drawn from one end of the pipe line to the other, assuming that the pipe is uniform in size. A long pipe line must generally follow the contour of the ground surface, as the expense of installing the pipe to a uniform gradient will be prohibitive in most cases.

Obviously, care should be exercised to avoid excessive differences in elevation. In many instances excessive differences in the grade line can be overcome without adding materially to the cost of laying the pipe. For example, where short high peaks or deep ravines are encountered, sharp changes in grade may be avoided or reduced by deeper cutting through the peak or by constructing fills across the ravines.

Some method must be provided to prevent the accumulation of air in the high points of a discharge line, for entrained air will accumulate gradually at the peaks and, unless released, will cause a material increase in pressure and a reduction in delivery. Air may be removed by hand-operated valves or by means of automatic air valves. The latter are to be preferred as they release the air automatically as it accumulates, while hand-operated valves remove it intermittently, so that there is always some air present except while the valves are opened for the bleeding operation. Blow-off valves should also be provided where the water carries sediment, located at low points in the line and operated at regular intervals, the period depending on the amount of sediment present in the water.

Gravity lines may be laid with the contour of the ground as in the case of discharge or pressure lines. However, gravity pipe lines should be laid so that no part of the pipe line is above the hydraulic gradient, as the pressure in that portion of the line above the hydraulic gradient will be lower than the atmospheric pressure, with the result that air may accumulate in the line, thus reducing, or even stopping the flow of the water. Slight elevations above the hydraulic gradient may sometimes be overcome by means of a siphon effect. This, however, necessitates special provision for the removal of air from the line.

Suction lines must be laid to a uniform gradient and with a slight fall from the pump to the source of supply, except where the water is delivered to the pump under pressure. Any irregularity in the gradient of a suction line will interfere with the operation of the pump because of air which will accumulate at the high points. Centrifugal pumps will not operate under such conditions. While the presence of air in the suction line is not so serious with positive-displacement pumps, it will interfere seriously with their operation, except where correctly-designed vacuum chambers are provided, with provision for the control of air accumulations.

Uniform Gradient Best

By Assistant Engineer

Normally, the more nearly a pipe line, whether it be a discharge line, a suction line or a gravity line, conforms to a uniform gradient, the less trouble may be expected in its operation. Usually, there is no particular difficulty in obtaining a uniform gradient where the pipe line extends only a short distance. On the other hand, if the pipe line is a long one, it will probably be necessary to follow the general inequalities of the surface of the ground, because the cost of doing otherwise would be prohibitive. The

result will be that there will be a number of summits or high points and corresponding sags or low points.

Entrained air in the water always seeks to escape; as it does so it accumulates at the high points and reduces the carrying capacity of the pipe. Likewise, sediment and solids carried in suspension tend to collect at the low points and also restrict the pipe section. The air can be bled off by means of automatic air valves, which allow the accumulated air to escape but will not allow the water to pass. In the same way the matter that has settled out of the water can be disposed of by means of blow-off valves at the low points in the line.

Where a pipe line is laid in undulating country, care must be exercised to insure that no part of it lies above the hydraulic gradient. If this occurs in a discharge (pressure) or gravity line, water will refuse to flow through it, and the only way to correct the trouble will be either to lower the pipe so that it will all lie below the hydraulic gradient or to raise the hydraulic gradient enough to pass over the high point in the pipe.

Some uncertainty seems to exist as to what the hydraulic gradient really is. If a series of small vertical pipes are inserted into the main pipe line, the hydraulic gradient will be the line connecting the elevations to which the water will rise in each of these small pipes while the line is in operation. If the flow is unobstructed, this gradient will be a straight line; if there is a restriction at any point, the line representing the gradient will be broken at that point. In other words, the hydraulic gradient represents the pressure at all points throughout the length of the pipe line.

Who Should Grind Switch Points?

Should section foremen be allowed to grind switch points, stock rails and frogs where welding is not required, or should this work be assigned to specially-trained men? Why?

Does Not Favor

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

If the stock rail is worn so badly that the switch point is too high, new stock rails should be installed. If the switch point is so worn that it must be ground to make it safe when closed against the stock rail, the point should be welded, not ground. If there is an overflow of metal on the stock rail, the point will not fit against it but will break or wear badly long before it should. This overflowing metal should be ground off, as this will extend the life of the points materially. The frog is the weakest part of the track, and no action should be taken that will weaken it still further, by grinding anything off, or in any other manner. However, frogs should be watched closely and should be welded before wear has reached the point where there is danger of breakage.

The best way to take care of this work is to assign men to do it, who are more skilled than the foreman is likely to be. Then the foreman will be called on to do work of this character only in emergencies. It is my observation that trained men will perform this work better and more economically than any foreman or trackman who is called on to do it only occasionally. On a busy railroad there is always enough work on a supervisor's district and in large yards to keep trained men employed full time.

Foreman Should Know

By Division Engineer

It is assumed that the question refers to supervision by the foreman rather than to actual performance of the work. In general, the largest amount of grinding will occur in large yards and busy terminals. If there is, as there usually is, a sufficient amount of grinding, both with and without welding, to require the services of one or more men, it will be best to employ a trained man with a helper to do the grinding.

Where this amount of grinding is needed, it would be poor management to expect the foreman, or foremen, to do any part of the work, because he has many other duties that require his attention. He should be competent, however, to do the work, and able to supervise it when some one else is doing it.

Out on the line, no one foreman has a large amount of grinding to be done, so that the permanent employment of a trained man on individual sections is not called for. Several different arrangements to get the work done are possible, however, but local conditions will determine which will be best adapted in particular cases. In giving this matter consideration, it should be borne in mind that where there is not enough work to keep a man employed, there is also too little to keep the grinding equipment employed continuously, and it will not be economical to assign it permanently to the territory.

For these reasons, when there is enough grinding to be done on a supervisor's district, or on a division, to require continuous employment of the grinding equipment, a trained man and a helper can be sent over the district or division, as needed, to do the work.

Where the district or division does not have enough grinding to warrant the employment of a full-time man, the foremen on the territory should be instructed to do the work, and the grinder can be passed progressively from section to section until the work has been completed. In this case, it is unlikely that the time required on any section will be a serious handicap to the work if the grinding is done by the foreman. If, however, some particular section has considerably more work than the average, one of the men in the gang can be trained to do the grinding, thereby releasing the foreman to care for his other work.

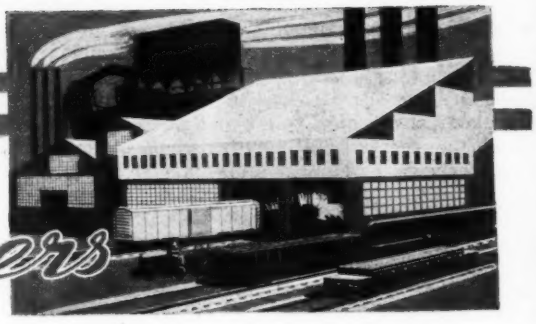
They Should Be Competent

By H. F. Fifield
Engineer Maintenance of Way, Boston & Maine, Boston, Mass.

When fully instructed, section foremen should be competent to supervise the grinding of burrs and lips from switch points, stock rails and frogs where no welding is being done. The actual handling of the grinder should be delegated to some one in the gang, who has been instructed by the foreman or some other competent instructor. Where there is a considerable amount of grinding to be done, as in large yards, foremen have more important duties than the operation of the grinding machines. It is recommended, therefore, that this duty be performed under his supervision by some member of his gang.

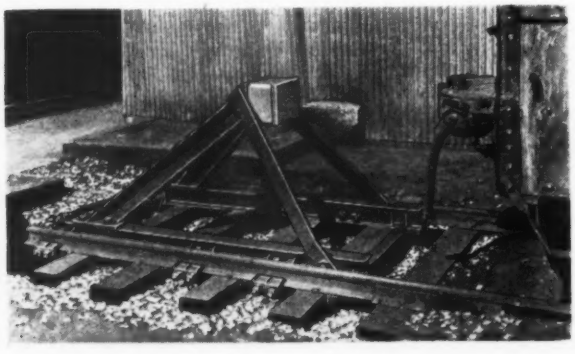
Where grinding is required out on the line, it is more satisfactory and more economical, while more uniform work can be obtained, if the work is assigned to a foreman and one man, who are qualified to move over the division to do the necessary grinding, furnishing them with a motor car and the needed grinding equipment.

PRODUCTS of Manufacturers



Pettibone Mulliken Clamp-Type Bumping Post

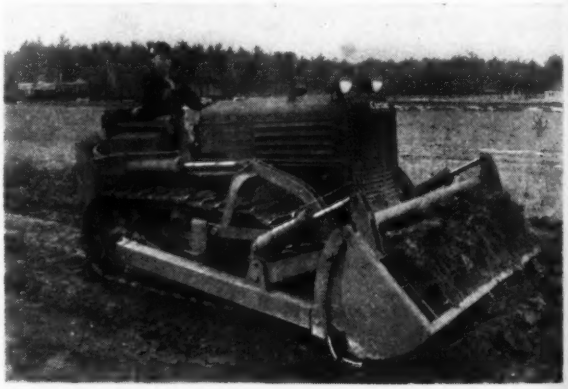
THE Pettibone Mulliken Corporation, Chicago, has developed a new all-steel, welded-clamp-type bumping post which can be installed without the necessity of drilling holes in the track rails, and which can be removed readily to a new location. The new unit is locked rigidly to each rail by means of three heavy-duty clamps, which are attached to each of two longitudinal H-beam base members, while the head, rear legs and base members are of one-piece welded construction. Other features of the bumping post include: (1) yoke strains are equalized by pivot fastenings of an extra-heavy steel yoke bar to the base members; (2) impacts are partially absorbed by buffers which bear against the ties; (3) a clamp take-up adjustment is provided on front and rear tie bars; and (4) shear on all bolts is eliminated by shear blocks welded to the base members. It is said that the heavy H-beam base members of this bumping post support and prevent humping of the rail, that the post is designed so that off-center impact stresses will be equalized and proper alinement maintained, and that these features assure longer life and lower maintenance costs. Specifications of the bumping post are: Length from face to rear of bumper, 5 ft. 3 in.; overall length, 7 ft. 9 in.; and weight, 1,550 lb.



An Installation of the New All-Steel Welded-Clamp-Type Pettibone Mulliken Bumping Post

New Drott Bull Clam Shovel

THE Hi-Way Service Corporation, Milwaukee, Wis., has developed the Drott bull clam shovel, which is designed to be attached to the front ends of tractors for use in a variety of work, such as bulldozing, grading, ditching and handling materials. The Drott bull clam is primarily a wide bucket-shaped bulldozer with a cutting edge along the bottom of the bucket. It cuts a wide swath and can accurately load earth with cuts from ½ in. to 8 in. deep, depending upon the setting of the depth gage, which can be controlled by the tractor operator wihout leaving his seat. This equipment can move earth forward or backward and to the right or left, and the shovel can be tilted to the right or left as desired. It can also be used to pick up heavy materials, such as a railroad rail or telegraph pole, and carry them where needed. The clam shovel, with its load, is usually skidded or semi-skidded ahead of the tractor, but it can be lifted 30 to 36 in. above the ground line.



A Drott Bull Clam Shovel Mounted on a Cletrac Tractor

It is said that the bull clam shovel has greater flexibility of operation and a number of specific advantages, as compared with conventional bulldozers, some of which are: The front part of the clam, or bucket, acts as a depth gage in front of the cutting edge; the clam makes it possible to gather a larger load ahead of the blade and prevents spillage when traveling; and it makes it possible to bulldoze a load around a corner and eliminates the need of continuous digging and rolling of the dirt when transporting the load. It also maintains a smooth burrow at all times without a constant strain on the operator, and makes it possible to pick up and

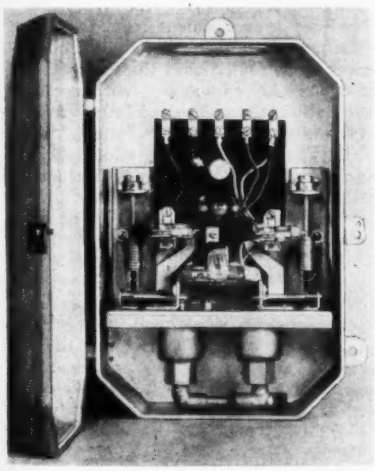
handle round stones, timbers, rails and other materials or obstructions.

The Drott bull clam is available in three sizes, with lifting capacities of 3,000, 6,000 and 12,000 lb.

Automatic Pumping Control

THE Automatic Control Company, St. Paul, Minn., has redesigned its Type E Tanktrol to better fit it to railroad water service requirements by completely enclosing the adjustment of the pumping controls and by making provision for locking the control box. This prevents unauthorized persons tampering with the Tanktrol adjustments.

The Type E Tanktrol is a pressure-type, single-pump, remote-control device for elevated tank systems, providing surge and backspin protection. It has two pressure elements, independently adjustable, for starting and stopping the pump at low and high levels, which are said to operate with an accuracy of one per cent and thus provide close control of the water level in the tank. The use of two bellows and properly proportioned leverage with light springs, which make it possible to reduce the amount of movement to a small arc, tend to lengthen the life of the unit and to provide greater



Showing Interior of a Type E Tanktrol Unit

accuracy. The surge and backspin protection is provided by a thermal time relay, which can be adjusted for a delay varying from 45 sec. to 2½ min. This thermal timer locks the starter in during the surge period, and then control is transferred automatically to the high-level unit.

These units are housed in waterproof cases of welded steel construction and are made for use in four ranges of pressure, as follows: 5 to 40 lb. (12 to 90-ft. head); 40 to 85 lb. (90 to 195 ft. head); 85 to 225 lb. (195 to 515 ft. head); and 225 to 300 lb. (515 to 690 ft. head). They are also made for connection to 110, 220, 440 or 550-volt a.c. current and 6, 12, 24, 115 or 230-volt d.c. current.

New Books

Bridge and Building Proceedings

PROCEEDINGS, American Railway Bridge and Building Association of 1943, 194 pages illustrated, 6 in. by 9 in. Bound in cloth. Published by the Association, Elinor V. Heffern, secretary, 310 South Michigan Avenue, Chicago. Price $2

This volume contains the reports and addresses which were presented at the fiftieth annual meeting of the association in Chicago on October 20-21, 1943, together with the discussions that followed their presentation, and the minutes of the business session of that meeting. Reflecting wartime conditions, many of the addresses and reports deal specifically with the shortages of labor and the restrictions on materials as they affect the railroads, and particularly bridge, building and water service forces.

The subjects covered by the reports include: Men—How to Secure and Hold; Materials—Possibility of Relief Through Substitutes; Revising Working Practices to Eliminate Interference with Traffic; Securing Maximum Utilization of Work Equipment; Carrying Over Bridges and Trestles; Salvaging Bridge, Building and Water Service Materials; and Maintaining Coaling and Sanding Plants to Meet Today's Requirements.

Continuing the emphasis on wartime problems, the addresses include: A Bird's-Eye View of the Railroad Man-Power Situation, by Edwin M. Fitch, assistant director, Division of Transport Personnel, Office of Defense Transportation, Washington, D. C.; High School Boys Make Good in Maintenance Work, by W. G. Powrie, engineer maintenance of way, Chicago, Milwaukee, St. Paul & Pacific, Chicago; Extra Gang of Women Makes Good on the Pennsylvania, by Malcolm Young, track supervisor, Pennsylvania, Warsaw, Ind.; Part-Time Week-End Workers Aid Substantially, by L. E. Peyser, principal assistant architect, Southern Pacific, San Francisco, Cal.; What Can We Expect in Materials?, by Albert C. Mann, vice-president, purchases and stores, Illinois Central, Chicago; The Material Problem—As Seen by a Bridge Man, by A. M. Knowles, engineer of structures, Erie, Cleveland, Ohio; The Material Situation—What Building Men Can Do About It, by A. L. Sparks, architect, Missouri-Kansas-Texas, St. Louis, Mo.; The Material Situation—Water Service Men Can Do Much to Help, by E. M. Grime, engineer water service, Northern Pacific, St. Paul, Minn.; Materials—Suggestions from W.P.B., by O. F. Dalstrom, assistant chief, Way and Structures section, Transport Equipment division, W. P. B., Washington; The Car Supply—As Affected by Maintenance of Way Operations, by Warren C. Kendall, chairman, Car Service division, A.A.R., Washington; and Railway Men at War, by Lt. Col. Robert A. Radford, chief, Engineering branch, Railway division, Office of Chief of Transportation, U. S. Army.

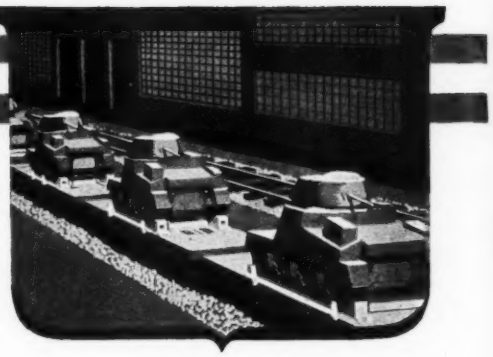
Proceedings of Roadmasters' Association

PROCEEDINGS, Roadmasters' and Maintenance of Way Association of America for 1943. 113 pages illustrated, 7 in. by 10 in. Bound in cloth. Published by the Association, Elinor V. Heffern, secretary, 310 South Michigan Avenue, Chicago. Price $2

This volume contains the reports, including discussions, presented at the one-day executive meeting of the association in Chicago on September 15, 1943, which, because of war-time conditions, replaced the association's usual three-day annual meeting. The book also contains an annual summary of the business of the association, including reports of the secretary, and treasurer, and a roundtable discussion which followed the presentation of the regular reports.

The subjects covered by the reports include: Getting the Most from Cross-ties; The Housing of Track Laborers; Saving Labor Through More Intensive Use of Equipment; Extending the Life of Switches, Frogs and Crossings; Educating Track Labor in the Salvage of Material; and Reducing the Use of Revenue Cars in Non-Revenue Service. The subjects considered in the roundtable discussion include: Effects of Rolling Stock on Self-Guarded Frogs; In Double-Track Territory, Should Rail Be Laid and the Track Surfaced Against Traffic?; Advantages of Different Mowing Machines; and Overcoming Labor Shortages.

NEWS of the Month



End Man-power Control For All War Veterans

The War Manpower Commission has announced the lifting of all man-power controls for veterans of the present war. This action was taken, it was explained, to speed the re-employment of returning veterans and to remove all employment obstacles in the way of their return to their civilian lives.

Plan Fare Cut for Military Personnel

The Senate last month passed and sent to the President the House-approved bill, H.R. 5196, to clarify Section 22 of the Interstate Commerce Act so as to remove any doubt as to the authority of common carriers to grant reduced rates to personnel of the armed services while on furlough or for a period of 30 days following their discharge.

General Ross Lauds Military Railroaders

Maj.-Gen. Frank S. Ross, chief of transportation for the European Theater of Operations of the U. S. Army, recently commended all personnel and units of the Military Railway Service for their "excellent and noteworthy accomplishments in the recent assigned task of moving supplies to the forward armies." The commendation was sent to all railroad units in France.

Engineering Research Under New Committee

As a result of a recent reorganization approved by the General committee of the Engineering division of the Association of American Railroads, and Vice-President C. H. Buford of the A.A.R., the research work of the division is now under the general supervision of a new committee consisting of H. R. Clarke, chief engineer of the C. B. & Q., chairman; B. R. Kulp, chief engineer of the C. & N. W.; and W. H. Penfield, chief engineer of the C. M. St. P. & P. For the purpose of providing a committee with whom G. M. Magee, the research engineer of the division, can confer whenever circumstances require, it was deemed best to select the personnel from among engineering officers located in Chicago.

The research committee of the Engineering division, as organized previously, consisted of the chairman of the Engineering division and one representative each of the Construction and Maintenance section, the Signal section and the Electrical section.

Pension Board Spends 39c to Disburse Dollar

The Railroad Retirement Board has cost railroad employees and railroad companies $17,000,000 in disbursing $44,000,000 for unemployment insurance benefits, according to J. F. Deasy, vice-president in charge of operation of the Pennsylvania, in an address at a meeting of railroad shop craft employees at Chicago on October 17.

"No one will dispute the proposition that labor and management would be performing a good service if they were jointly contributing to sound retirement and unemployment insurance plans, and if the contributions were used only to administer those plans efficiently," Mr. Deasy said.

Railroads are to Continue Short of Man-power

In the opinion of Brig.-Gen. Leonard P. Ayres, economic adviser to the president of the Chesapeake & Ohio Lines, termination of the war in Europe will not occasion any lessening of existing shortages of man-power on railroads, or for that matter, any sizeable drop in freight and passenger traffic.

Writing for the current issue of "Tracks," employee magazine of the C. & O., General Ayres advanced the view that "for a good many months to come the railroads of this country will continue to be short of man-power and long of traffic," and that this latter condition will likely obtain as long as the war with Japan continues.

Milwaukee Track Foreman Is Awarded Medal of Honor

President Roosevelt has bestowed a medal of honor on Roy A. Powers, Rockford, Ill., a Chicago, Milwaukee, St. Paul & Pacific track foreman, for his rescue of an aged woman from the path of an approaching passenger train on the Chicago, Burlington & Quincy at Rockford on June 14, 1943. The award was made upon recommendation of the Interstate Commerce Commission, under the Act of February 23, 1905, which provides for bronze medals of honor in recognition of outstanding feats of bravery connected with the saving of life upon railroads.

Mr. Powers and the woman he rescued were both seriously injured, the commission's announcement pointing out that they are "still confined to hospitals, more than one year after the accident."

Western Roads Get Man-Power A-Priority

Acting to "speed the interregional recruitment of 974 switchmen, 1,030 brakemen, and 329 firemen," the National Manpower Priorities Committee this week authorized a national A-priority rating to meet man-power requirements of 13 railroads serving the West coast. The joint announcement from the Office of Defense Transportation and War Manpower Commission said this list of train service employees was in accordance with the railroads' expressed needs; and "workers are needed immediately."

The announcement also quoted O.D.T. officials as saying that the shortage of switchmen, firemen and brakemen on the West coast had become "increasingly serious within the last six weeks," this being "especially true" in the San Francisco Bay area, where O.D.T. recently announced that the "shortage was congesting freight yards and sidings and was slowing up the movement of war freight." On the whole West coast, the reports also showed, "350 to 400 switchmen are working double shifts daily."

U. S. Bars Relief Service for Tourists

The Office of Defense Transportation "will under no circumstances" provide relief trains for this winter's Florida tourists, and vacationists who find themselves stranded at Southern resorts "will have only themselves to blame," Director J. Monroe Johnson of the Office of Defense Transportation warned in an October 12 statement. Last season, O.D.T. authorized the operation of additional daily coach services from Florida to New York for a 30-day period beginning March 1, 1944.

Personal Mention

General

Roscoe G. Davis, supervisor of track on the Pennsylvania at Shire Oaks, Pa., has been promoted to superintendent of general office buildings, with headquarters at Pittsburgh, Pa.

W. C. Smith, acting general manager of the Detroit Terminal Railroad Company, has been promoted to general manager and chief engineer, with headquarters as before at Detroit, Mich.

F. Berkeley Robins, assistant general supervisor of bridges and buildings on the Chesapeake & Ohio, with headquarters at Richmond, Va., has been appointed assistant director of the Division of Materials and Equipment, Office of Defense Transportation. For several months Mr. Robins has been serving as a staff officer of the Combined Production and Resources Board of O.D.T.

Robert G. Vawter, assistant division superintendent on the Chesapeake & Ohio, and a maintenance officer by training and experience, has been promoted to superintendent of the Russell division, with headquarters at Russell, Ky. Mr. Vawter was born on May 9, 1895, at Greenville, W. Va. He began his railway career as a rodman with the Virginian in March, 1916, and continued there until September, 1916, when he became a transitman on highway work. In October, 1917, he joined the Chesapeake & Ohio as an assistant engineer, and was assigned the position of supervisor of track in October, 1920. He served in this capacity until December, 1925, when he was named yardmaster, becoming assistant trainmaster in April, 1926. Mr. Vawter was advanced to trainmaster in April, 1928, which position he held until his appointment as assistant superintendent at Hinton, W. Va., in July, 1942. He was transferred to the Peach Creek division on January 1, 1944, where he remained as assistant superintendent until his recent promotion to the position of superintendent of the Russell division.

Morton S. Smith, superintendent of the Logansport division of the Pennsylvania, with headquarters at Logansport, Ind., and an engineer by training and experience, has been advanced to superintendent of freight transportation, with headquarters at Chicago, **succeeding James P. Newell, Jr.,** whose promotion to general superintendent of the Southwestern division is reported elsewhere in these columns. Mr. Smith was born at Hughesville, Pa., on July 1, 1906, and attended Pennsylvania State College. He entered railway service on June 24, 1929, as assistant on the engineer corps of the Pennsylvania at Lancaster, Pa., and in the same year he was appointed assistant supervisor of track, serving in that capacity on the Baltimore, Philadelphia, Maryland and Middle divisions. In 1933 Mr. Smith was promoted to supervisor of track on the Monongahela division, and until 1939 he served in the same capacity on various other divisions. In 1940 he was advanced to division engineer of the

Morton S. Smith

Monongahela division, and in February, 1943, he was transferred to the Long Island Railroad (a subsidiary of the Pennsylvania), with headquarters at Jamaica, N.Y. In July, 1943, he was promoted to the position he held at the time of his new appointment.

James P. Newell, Jr., superintendent of freight transportation on the Pennsylvania at Chicago, and an engineer by training and experience, has been promoted to general superintendent of the Southwestern division, with headquarters at Indianapolis, Ind. Mr. Newell was born at Carthage, Mo., on September 18, 1902, and was graduated from Prince-

James P. Newell, Jr.

ton University in 1924. He entered railway service in 1927 as an assistant on the engineering corps of the Pittsburgh division of the Pennsylvania, and the following year he was promoted to assistant supervisor of track at Sharpsburg, Pa. In December, 1928, he was transferred to Carnegie, Pa., and in July, 1929, he was promoted to supervisor of track on the Buffalo division, with headquarters at East Aurora, N.Y. Mr. Newell later served as supervisor of track on the E. & A., Pittsburgh, Middle and Maryland divisions, being located at Wilmington, Del., in May, 1934, when he was promoted to assistant division engineer of the Middle division, with headquarters at Altoona, Pa. In July, 1937, he was transferred to the office of the vice-president, operation, at Philadelphia, Pa., and in March, 1938, he was advanced to division engineer of the Long Island railroad, with headquarters at Jamaica, N.Y. In April, 1940, he was advanced to superintendent of the Logansport division, and two years later he was transferred to the St. Louis division, with headquarters at St. Louis, Mo. On April 1, 1943, Mr. Newell was promoted to the position he held at the time of his new appointment.

Sherman Smith, whose retirement as superintendent of the Calgary division of the Canadian National was reported in the October issue of *Railway Engineering and Maintenance*, was born at Omaha, Neb., on August 26, 1879, and graduated from Dartmouth College in 1903. He received the degree of Civil Engineering from Thaver School of Civil Engineering in the following year. He entered railway service in May, 1904, as an instrumentman on the Chicago & North Western, and from July, 1904, to August, 1905, was employed in the chief engineer's office of the Union Pacific at Omaha, Nebr. For the next two years he served as office engineer at Denver, Colo., and then resigned to become resident engineer on the Canadian National at Rivers, Man. He held this latter position until July, 1908, when he was promoted to assistant engineer at Melville, Sask. In September, 1918, he was promoted to assistant superintendent at Edson, Alta., and was transferred to Calgary in August, 1928, and to Edmonton in September, 1937. In December, 1939, he was promoted to the position he held at the time of his retirement.

Howard H. Clark, whose promotion to superintendent of the Kent division of the Erie, with headquarters at Marion, Ohio, was reported in the October issue of *Railway Engineering and Maintenance*, was born at Buffalo, N.Y., on April 16, 1905, and received his higher education at Cornell University. He entered railway service in June, 1926, as a levelman on the Lehigh Valley, and two years later he went with the Erie in the same capacity at Buffalo, later serving as transitman and engineer in charge of the Buffalo yard improvements. In April, 1929, he was appointed chief of the curve lining corps on the Susquehanna division, subsequently serving as maintenance inspector and general yard foreman at various points on the road. In December, 1932, Mr. Clark was promoted to track supervisor, with headquarters at Hackensack, N.J., and one year later he was advanced to assistant division engineer at Buffalo. In June, 1936, he was appointed inspector of operation at Cleveland, Ohio, and in May, 1937, he was advanced to trainmaster, with headquarters at Jersey City, N.J. In 1939 he was transferred to Marion, and in 1940 to Meadville, Pa.

In March, 1942, Mr. Clark was promoted to the position he held at the time of his new appointment.

C. I. Leiper, chief engineer of the Central region of the Pennsylvania, has been elected a vice-president, with headquarters at Pittsburgh, Pa. Mr. Leiper was born at Wallingford, Pa., on October 28,

C. I. Leiper

1874. He attended Swarthmore College and entered railroad service in 1897 as a transitman in the construction department of the Pennsylvania at Altoona, Pa. He served as assistant supervisor of the Maryland division from 1901 to 1903, when he was promoted to supervisor, thereafter acting in that capacity on the Maryland, Pittsburgh and New York divisions. In 1909 he was named division engineer of the Manhattan division, being transferred to the New York division in 1911. From June, 1913, to February, 1914, he was principal assistant engineer of the Philadelphia, Baltimore & Washington (part of the Pennsylvania), later becoming superintendent of the New York, Philadelphia & Norfolk (part of the Pennsylvania) at Cape Charles, Va. In June, 1917, Mr. Leiper was named superintendent of the New York division of the Pennsylvania at Jersey City, N.J., and held that position until February, 1920, when he became general superintendent of the New Jersey division at New York. He was advanced to assistant general manager, Eastern region, at Philadelphia, Pa., in October, 1923, and in September, 1926, he was promoted to general manager, Central region, with headquarters at Pittsburgh, Pa. On February 1, 1939, he was named chief engineer of the Central region with the same headquarters, the position he held at the time of his recent election as vice-president.

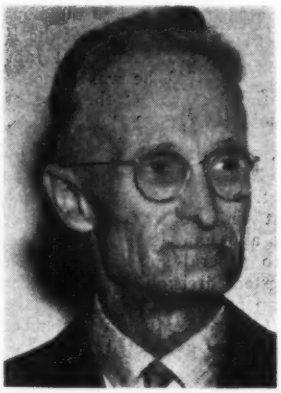
Engineering

R. C. Davidson, roadmaster on the Smithers division of the Canadian National, has been promoted to assistant engineer, with headquarters at Prince George, B.C.

A. Rodriguez y Parra, engineer maintenance of way of the National Railways of Mexico, has been promoted to chief engineer, with headquarters as before at Mexico City, Mexico. **Carlos Malagamba** has been appointed engineer maintenance of way, in his place.

G. S. Smith, assistant division superintendent on the Missouri Pacific at Nevada, Mo., has been appointed acting division engineer on the Southern Kansas-Central divisions, with headquarters at Coffeyville, Kan., succeeding **R. G. Bush,** who has been granted a leave of absence due to illness.

John R. Rushmer, assistant engineer, Western Lines, of the Atchison, Topeka & Santa Fe, with headquarters at Amarillo, Tex., has been promoted to roadway engineer, system, with the same readquarters. Mr. Rushmer was born at Pueblo, Colo., on March 26, 1893, and entered railway service in 1914 as a chainman on the Santa Fe, being transferred to the chief engineer's office at Amarillo one year later. He entered the armed services during World War I, and after the war he returned to the chief engineer's office as a computer. In May, 1941, Mr. Rushmer was advanced



John R. Rushmer

to right-of-way agent, and on July 1, 1942, he was promoted to the position he held at the time of his new appointment.

James R. Watt, Jr., assistant supervisor of track on the Mohawk division of the New York Central, with headquarters at Albany, N.Y., has been appointed assistant engineer in the office of the engineer of track of the Lines Buffalo and East, with headquarters at New York, to succeed **John E. Spangler,** whose appointment as supervisor of track is noted elsewhere in these columns.

Halbert H. Hall, whose promotion to division engineer on the Chicago, St. Paul, Minneapolis & Omaha (part of the Chicago & North Western System), with headquarters at St. Paul, Minn., was reported in the October issue, was born at Chicago on May 5, 1901, and received his higher education at the Crane Junior College and the University of Illinois. He entered railway service on July 20, 1926, as an instrumentman on the North Western at Madison, Wis., later serving in that capacity and as a rodman at Malone, Iowa, and Lincoln, Neb. He left the North Western in 1927 to complete his education, returning in 1928 as an instrumentman, with headquarters at Winona, Minn. Mr. Hall served in this capacity at various points of the road until April, 1944, when he was promoted to assistant general bridge inspector, system, the position he held at the time of his new appointment.

Robert L. Groover, principal assistant engineer on the Atlantic Coast Line, has been promoted to assistant chief engineer, with headquarters as before at Wilming-

Robert L. Groover

ton, N.C. **William J. Turner,** engineer of design, has been advanced to principal assistant engineer at Wilmington, succeeding Mr. Groover.

Mr. Groover was born at Quitman, Ga., on November 7, 1891. He was graduated from Alabama Polytechnic Institute with a B.S. degree in civil engineering in June, 1914, and entered railroad service the following September as a draftsman and instrumentman on the Atlantic Coast Line, maintenance of way department. After serving briefly with the Central of Georgia as a draftsman, from March, 1916, to November, 1916, he rejoined the Atlantic Coast Line as a computer and pilot engineer in the valuation department. In October, 1918, he was named assistant engineer maintenance of way, and held this position until May, 1920, when he was appointed assistant engineer in the chief engineer's office. He served as office engineer from November, 1924, until June, 1929, when he was advanced to engineer of design, in which position he remained until December, 1941, when he was promoted to the position he held at the time of his recent appointment. From May 31, 1943, to September 16, 1944, Mr. Groover served with the Office of Defense Transportation at Washington, D.C., as associate division direction, Controlled Materials section, way and structures.

Mr. Turner was born in Pike County, Ala., on January 16, 1902. After attending Alabama Polytechnic Institute, Auburn, Ala., he entered railroading in June, 1925, with the Atlantic Coast Line, as a rodman in the construction department, and was promoted to transitman the following September. He became a junior engineer in the chief engineer's office in

September, 1928, and then served as assistant engineer, office engineer, and senior assistant engineer at Jacksonville, Fla., until May 1, 1940, when he was

William J. Turner

advanced to division engineer there. Mr. Turner was transferred to the chief engineer's office as engineer of design in 1942, and held that position until his recent promotion.

William H. B. Bevan, whose promotion to district engineer on the North Ontario district of the Canadian National, with headquarters at North Bay, Ont., was reported in the October issue, was born at Harrison, Ont., October 13, 1883. He entered railroad service as a rodman in May, 1902, and the following year was named inspector of the Toronto-Washago territory. As resident engineer he went to Ottawa, Ont., in June, 1907, being transferred later to other points on the system. He entered military service on August 16, 1914, and was awarded the Distinguished Conduct Medal. On his return in April, 1919, he became engineer of bridge surveys in Ontario and Quebec. On July 21 of that year Mr. Bevan was appointed division engineer, maintenance of way, at Ottawa, and on January 1, 1920, was promoted to assistant district engineer at Toronto. Some time later he was appointed division engineer of the Montreal (Que.) terminals, and on March 1, 1939, was moved to Ottawa as division engineer, returning to Montreal on June 26, 1944, as acting district engineer. This post Mr. Bevan held until his present appointment.

Track

C. W. Butts, whose appointment as supervisor of track on the Gulf, Mobile & Ohio, with headquarters at Murphysboro, Ill., was reported in the October issue, was born at Wickliffe, Ky., on September 1, 1902, and entered railway service on June 15, 1915, as a water boy on the Mobile & Ohio (now the G. M. & O.). He later worked as a brakeman, fireman, switchman, section laborer, section foreman, extra-gang foreman, and with a ditcher outfit, all on the Northern division.

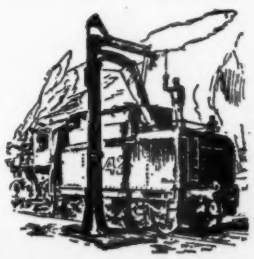
C. C. Van Stratton, track supervisor on the Colorado division of the Missouri Pacific, has been promoted to roadmaster on the Wichita division, with headquarters at Yates Center, Kan., succeeding **A. E. Courtney,** who has been transferred to the Central division, with headquarters at Russellville, Ark., replacing **C. H. Sloan,** who has been assigned to other duties.

J. L. Hopkins, who has been employed as construction roadmaster on the San Diego line of the Atchison, Topeka & Santa Fe, has returned to his former position of track supervisor, with headquarters at Capistrano, Cal., succeeding **R. E. Kline,** who has been transferred to Los Angeles, Cal. Mr. Kline replaces **L. J. Dehring,** who has returned to his former position of section foreman, with headquarters at San Bernardino, Cal., at his own request.

Arthur O. Johnson, whose promotion to roadmaster on the Denver & Rio Grande Western, with headquarters at Pueblo, Colo., was reported in the September issue of *Railway Engineering and Maintenance,* was born at Bristol, Ill., on January 17, 1914, and entered railway service on August 8, 1936, as a section laborer of the D. & R. G. W. at Pueblo. He subsequently served as a timekeeper at Greenland, Colo., and as track inspector and relief foreman at Pueblo. On May 16, 1941, Mr. Johnson was promoted to section foreman, with headquarters at Littleton, Colo., and in the same year he returned to Pueblo as a track inspector, the position he held at the time of his new appointment.

Norman W. Kopp, whose promotion to supervisor of track on the Illinois Central, with headquarters at Grenada, Miss., was reported in the October issue of *Railway Engineering and Maintenance,* was born at Lismore, Minn., on September 30, 1917, and received his higher education at the State University of Iowa. He entered railway service on September 1, 1939, with the signal department of the Chicago, Milwaukee, St. Paul & Pacific, and in 1940 he went with the Illinois Central as a chainman, with headquarters at Memphis, Tenn. In the same year Mr. Kopp was promoted to rodman at Water Valley, Miss., and in October, 1942, he was advanced to the position he held at the time of his new appointment.

A. E. Myles, assistant supervisor of track on the Panhandle division of the Pennsylvania, has been promoted to supervisor of track, with headquarters at Columbus, Ind., succeeding **Kenneth Lieber,** who has been transferred to Shire Oaks, Pa., relieving **Roscoe G. Davis,** whose promotion to superintendent of general office buildings, with headquarters at Pittsburgh, Pa., is reported elsewhere in these columns. **J. W. Diffendeifer,** assistant on the engineering corps of the Eastern division, has been advanced to assistant supervisor of track on the Panhandle division, replacing Mr. Myles.



G. T. Weida, assistant supervisor of track on the Pennsylvania at Trenton, N. J., has been promoted to supervisor of track on the Logansport division, with headquarters at Union City, Ind., to replace **C. J. Webb,** who has been transferred to Columbia, Pa., to succeed **L. R. Bailey,** who has been transferred to the Washington Terminal Company, Washington, D. C., to succeed **F. H. Pflaging,** who has resigned.

Bridge & Building

H. L. Holderman, acting division engineer on the Black Hills division of the Chicago & North Western, with headquarters at Chadron, Neb., has been promoted to supervisor of wood preservation, with headquarters at Escanaba, Mich.

C. L. Wynne, scale inspector on the Missouri Pacific, with headquarters at St. Louis, Mo., has retired after 35 years of service.

Carl F. Houser, assistant master carpenter on the Erie, with headquarters at Paterson, N. J., has been promoted to master carpenter, with headquarters at Salamanca, N. Y., succeeding **M. G. Tribe,** deceased.

Onslow P. Shallenberger, whose promotion to master carpenter on the Denver & Rio Grande Western, with headquarters at Alamosa, Colo., was reported in the September issue of *Railway Engineering and Maintenance,* was born at Kansas City, Mo., on January 14, 1909. He graduated from the University of Colorado in 1932, and entered railway service on September 19, 1940, as a chainman on the D. & R. G. W. at Pueblo, Colo. In June, 1941, Mr. Shallenberger was promoted to engineer assistant, with headquarters at Denver, Colo., and in the same year he was transferred to Grand Junction, Colo. In November of that year he was advanced to office engineer, with headquarters at Pueblo. In September, 1942, Mr. Shallenberger was promoted to assistant engineer, with the same headquarters, holding that position until his new appointment.

Obituary

Victor R. Krueger, assistant engineer on the Chesapeake & Ohio at Richmond, Va., died October 13 in the Clifton Forge Hospital, Clifton Forge, Va. He was 47 years old.

John B. Dickson, who retired in 1917 as general manager, Lines West, of the Erie, and served as chief engineer of the Baltimore & Ohio from 1905 to 1907, died at his home in Youngstown, Ohio, on October 4.

Association News

Wood Preservers' Association

The Executive committee of the association met in the Hotel Stevens, Chicago, on October 18, in conjunction with the one-day Executive meeting of the American Railway Bridge and Building Association on that date.

Bridge and Building Association

The Executive committee of the association held a one-day business meeting in Chicago on October 18, at the Hotel Stevens. A report of the activities of this meeting, together with all eight of the technical reports presented at and acted upon at the meeting, is presented elsewhere in this issue.

Roadmasters' Association

In order to select the personnel of committees to study and report on technical assignments in the year ahead, President E. L. Banion has called a meeting of the Executive committee in Chicago on December 16. In the meantime, members are urged to return promptly the cards sent to them, indicating thereon the specific committees to which they prefer assignment.

Maintenance of Way Club of Chicago

With an attendance of 169 members and guests, the first fall meeting of the club was held on Monday evening, October 23, in the Ambassador Room of Huyler's Restaurant, Chicago. Following dinner, the meeting was addressed by H. A. Cassil, chief engineer, Pere Marquette, Detroit, Mich., and T. F. Burris, division engineer of that road at Grand Rapids, Mich., on The Employment of High School Boys in Track Maintenance Work. Both speakers spoke with enthusiasm concerning the employment of boys on their road during the last summer, and told of the many expedients adopted to insure the safety and well being of the boys, while at the same time securing constructive results from their efforts.

Railway Tie Association

The Twenty-Seventh annual meeting of the association will be held at the Netherland Plaza Hotel, Cincinnati, Ohio, May 8-9, 1945. The membership of committees which will present reports at that meeting has been selected and subjects have been assigned. These subjects, together with the chairmen of the committees, are as follows: (1) The Checking and Splitting of Ties Before Being Placed in Track, chairman, T. H. Patrick, treatment inspector, Chicago, Milwaukee, St. Paul & Pacific; (2) The Checking and Splitting of Crossties in Track, chairman, J. B. Akers, assistant chief engineer, Southern; (3) New and Pending Legislation Affecting the Crosstie Industry, chairman, B. N. Johnson, general superintendent of production, Wood Preserving Division, Koppers Company, Richmond, Ind.; (4) Efficient Manufacturing Practice and New Methods to Overcome the Shortage in Man-power, chairman, D. B. Frampton, president, D. B. Frampton & Co., Pittsburgh, Pa.; (5) The Moisture Gradient as a Factor in Treatment of Crossties (a joint study with a committee of the American Wood-Preservers' Association), chairman, W. P. Arnold, technical director, Wood Preserving Division, Koppers Company, Orrville, Ohio; (6) Proposed Changes in Specifications, chairman, D. C. Jones, district vice-president, Wood Preserving Division, Koppers Company, Chicago; (7) Timber Conservation, chairman, H. R. Condon, vice-president, Wood Preserving Division, Koppers Company, Pittsburgh, Pa.; (8) Concentration Yards, chairman, R. B. Smith, in charge of production, D. B. Frampton & Co., Pittsburgh, Pa.; and (9) Production Problems, chairman, Waldo Tiller, president, J. A. Tiller & Son, Little Rock, Ark.

American Railway Engineering Association

Four committees of the association plan meetings during November, as follows: Co-Operative Relations With Universities, in Chicago on November 1; Records and Accounts, in Chicago on November 1 and 2; Wood Bridges and Trestles, in Chicago on November 10 (tentative); and Roadway and Ballast, in Chicago on November 15 and 16.

During October the association published the first issue of its new monthly news bulletin, known as the A.R.E.A. News, designed to promote increased interest among members by apprising them currently of the activities of the association and its personnel.

Three committees of the association held meetings during October as follows: Water Service, Fire Protection and Sanitation, which met in Chicago on October 17; Masonry, which met in Chicago on October 17-18; and Buildings, which met in New York on October 24 and 25.

The November bulletin of the association, No. 448, will be distributed to members during the month, and will contain reports of the five following committees, to be presented before the association next March: Signals and Interlocking; Water Service, Fire Protection and Sanitation; Economics of Railway Location and Operation; Electricity; and Waterways and Harbors.

Supply Trade News

General

The **Pittsburgh Plate Glass Company** has announced plans to erect a new paint plant on a 14-acre tract recently purchased at Springdale, Pa. Construction will begin as soon as materials and equipment are available. The plant will service the company's outlets in the tri-state area which heretofore were supplied through the Newark, N.J., and Milwaukee, Wis., paint plants.

The U. S. Wind Engine & Pump Co., Batavia, Ill., has announced a change in name by elimination of the word "Wind," and the firm will hereafter be designated as the **U. S. Engine & Pump Co.** At the same time **President Henry R. Garssen** announced that the company is planning an expansion of its line of railroad equipment products by an increase in the number of models and the addition of new, related products.

Personal

Lawrence E. Cooney, district sales manager of the **Austin Company,** has been appointed vice-president and general sales manager.

Paul R. Dupree, for the past four years traffic manager at Jacksonville, Fla., for the **American Lumber & Treating Co.,** has been appointed general traffic manager for the company with headquarters at Jacksonville, Fla.

J. B. Kintner, manager of sales for the Union Steel Castings division of the **Blaw-Knox Company,** has been promoted to vice-president of the division.

John W. Sands, who has been with the Conservation division of the War Production Board at Washington, D. C., since January, 1942, has resumed his duties with the development and research division of the **International Nickel Company,** New York.

Robert E. Lewis, who resigned recently as treasurer of the **American Steel & Wire Co.,** a U. S. Steel subsidiary, has been elected president of the **Cleveland Wire Spring Company.**

John J. Farrell, assistant treasurer, has been appointed treasurer of the **American Steel & Wire Co.,** a U. S. Steel subsidiary, to succeed Robert E. Lewis whose resignation to become president of the Cleveland Wire Spring Company is reported elsewhere in this issue.

W. H. Savage has been appointed manager of the General Equipment and Materials department of the **Robert W. Hunt Company,** Chicago, **G. W. Stierer** has been appointed manager of the Structural Steel department and **H. A. Ford** has been appointed manager of the Railway Car department.

Lucien W. Moore, general purchasing agent of the **Crane Company,** has been appointed manager of the valve and fittings department, with headquarters at the company's general offices in Chicago. **Thomas J. Hanlon,** of the purchasing department, has been appointed purchasing agent to succeed Mr. Moore.

Harold D. Bates, assistant advertising and sales promotion manager for Johns-Manville at New York, has been appointed advertising and sales promotion manager of the **Phillip Carey Manufacturing Company. Chester L. Owens,** for the past ten years manager of the company's Cincinnati, Ohio, branch, has been

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appointed assistant general sales manager and **George B. Johnson,** formerly manager of the Marketing division, has been appointed general merchandising manager.

William J. Van Vleck, assistant manager of the Philadelphia, Pa., district office of the **Worthington Pump & Machinery Corp.,** has been appointed manager of the company's Atlanta, Ga., office to succeed **Edward Stauverman,** who has resigned to engage in another line of business. **C. W. Camp,** formerly with the Crocker-Wheeler Electric Manufacturing Company for 38 years, has become associated with Worthington as consulting electrical engineer.

C. W. Merriken, sales representative of the **Simmons-Boardman Publishing Corporation,** with headquarters at Chicago, has, in addition to his previous duties, been promoted to business man-

C. W. Merriken

ager of the Railway Engineering and Maintenance Cyclopedia, one of the Simmons-Boardman publications, with the same headquarters. Mr. Merriken was born at Baltimore, Md., on August 12, 1907, and received his higher education at the University of Illinois. He entered railway service in 1930 as a chainman on the Chicago & North Western, and one year later he went with the Chicago, Milwaukee, St. Paul & Pacific as a rodman at Chicago. From 1932 to 1935 he was associated with the sales department of the Pure Asphalt Company at Chicago, and in the latter year he returned to the North Western as a rodman on the Galena division. In March, 1938, Mr. Merriken went with the Belt Railway of Chicago as a rodman, and in October of the same year he resigned to become an associate editor of the Railway Engineering and Maintenance Cyclopedia. On March 4, 1940, he was appointed to the position he held at the time of his new promotion.

John S. Hutchins, vice-president in charge of sales of Ramapo Ajax (a division of the **American Brake Shoe Company**), has been elected an executive vice-president, with headquarters as before at Chicago. Mr. Hutchins was born in 1905 and was graduated from Yale University. He entered the employ of Ramapo Ajax in 1925 and was taken into the sales department in Chicago in 1927. He was later transferred to the Cleveland office and returned to Chicago in 1933, where he remained in charge of sales of the Chicago district until his

John S. Hutchins

appointment as district sales manager of Middle Western sales in 1941. In January of this year he was advanced to the position he held at the time of his new appointment.

F. E. Schaumburg, roadmaster on the Chicago & North Western, has resigned to join the **Caterpillar Tractor Company,** Peoria, Ill., as railroad representative, sales development division, with headquarters at Peoria. Mr. Schaumburg was born on May 30, 1899, at Jamestown, N.D. After public school education he entered railway service on December 10, 1917, as a trainman on the Northern Pacific at Jamestown, where he served later as a rodman and an instrumentman. On August 6, 1924, Mr. Schaumburg left the Northern Pacific to accept a position as

F. E. Schaumburg

assistant division engineer on the Eastern division of the Chicago Great Western, with headquarters at Chicago. After five years with this road he entered the service of the Chicago & North Western as a construction accountant, which position he held until December 21, 1929, when he was advanced to assistant roadmaster on the First subdivision of the Galena division, with headquarters at Chicago. On March 1, 1932, he was promoted to roadmaster on the eastern division, with headquarters at DeKalb, Ill., the position he held at the time of his new connection.

Richard J. Shanahan has been appointed field sales manager of the Railroad Equipment division of the **U. S. Engine & Pump Co.,** Batavia, Ill. Mr. Shanahan has been engaged as a sales engineer in the railroad field for the last 16 years, and prior to forming his new

Richard J. Shanahan

connection he was with the Gustin-Bacon Manufacturing Company. Previous to that he was connected with the Maintenance Equipment Company, and the Boss Bolt & Nut Co. Mr. Shanahan will maintain his headquarters at Batavia.

Obituary

John T. McGarry, president and general manager of the Railroad Products Company, Cincinnati, Ohio, and formerly connected with the American Valve and Meter Company died on October 9.

John P. Moses, former manager of railroad sales for Joseph T. Ryerson, whose death on August 18 was reported in the October issue, was associated with the Ryerson company for 41 years. He began his career with the company in the operating department and was later transferred to commercial sales and then to railroad sales. He was appointed manager of the railroad sales department in 1924, and served in that position until a few years ago when he relinquished management of the department but continued to serve in an advisory capacity.

W. K. Cox, whose promotion to assistant general sales manager of the **Caterpillar Tractor Company** was reported in the October issue, joined the Caterpillar Tractor Company in 1928 as a special representative on logging sales, and in 1932 he was assigned to industrial and general sales work. Four years later he was assigned to the advertising department, and in 1937 he was promoted to assistant manager of the Sales Development division. In 1941 Mr. Cox was advanced to assistant sales manager of the Eastern division, and to manager of that division in 1943.

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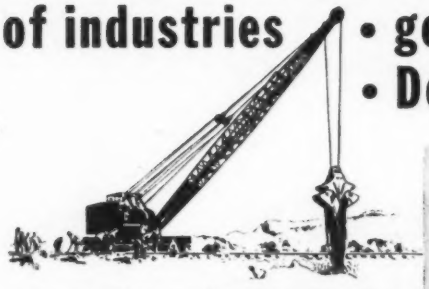

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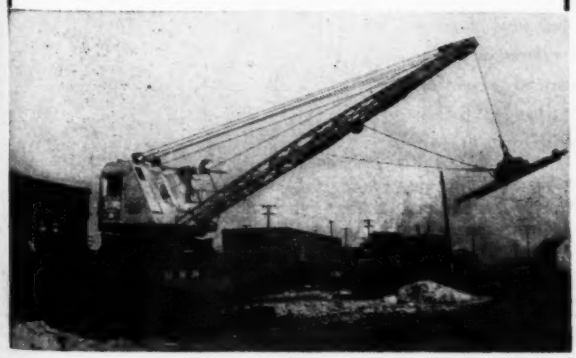

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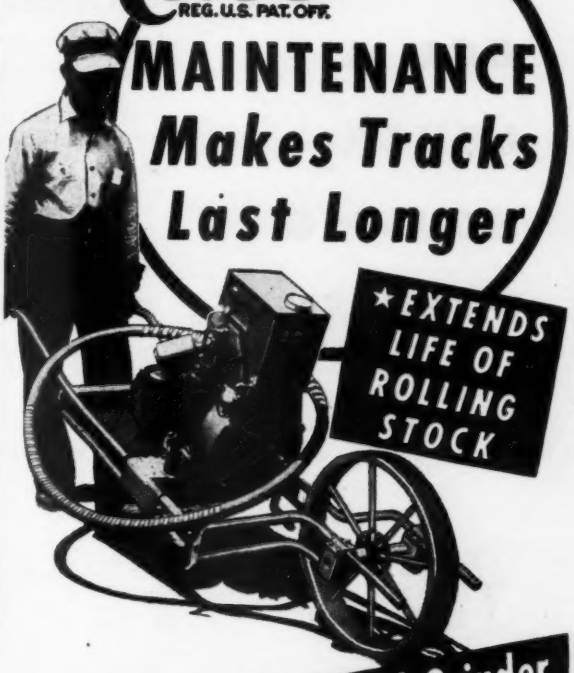

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Other MALL Portable Power Tools include Cross Slotters, Gasoline Engine, Pneumatic and Electric Concrete Vibrators and Surfacers, Gasoline Engine and Pneumatic Chain Saws, Electric Circular Saws, Electric Drills, Flexible Shaft Machines with attachments for sanding, grinding, polishing, wire brushing, buffing and drilling. Write for complete catalog to

Railroad Department

MALL TOOL COMPANY

7746 South Chicago Avenue, Chicago 19, Illinois

Offices in Principal Cities

Mall REG. U.S. PAT. OFF. **PORTABLE POWER TOOLS**

GOT A LABOR-HOUSING PROBLEM?

Here's one good way to solve it!

Use our ***specialized*** pre-fabricated buildings!

They're delivered, knocked-down, ready for quick, easy erection on block foundation. Heavy weatherproof walls over rigid frame. Completely demountable for removal to another site.

These buildings come in 16′ and 20′ widths. Can be used as separate units (see picture), or can be extended to any length by use of additional 8′ and 16′ length units.

Here's low-cost, practical housing that many big, well-known firms have found ideal for labor camps, barracks, kitchens, dining and recreation halls, tool houses, warehouses—and many other important uses. For full information get in touch with

EASTERN SHORE FABRICATORS, INC.

Mfrs. of ***SPECIALIZED*** *BUILDINGS*

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PENN R. R. HAS SOLVED ITS HOUSING PROBLEM HERE:
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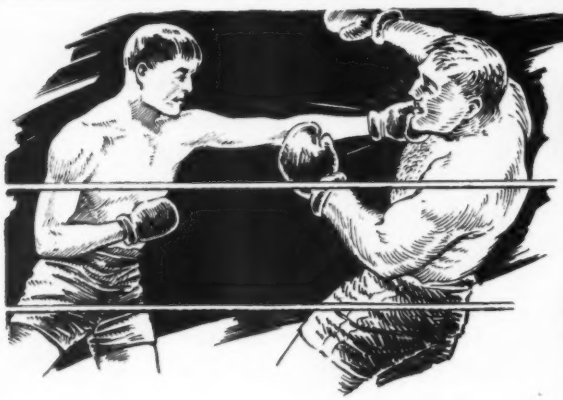


POWER!

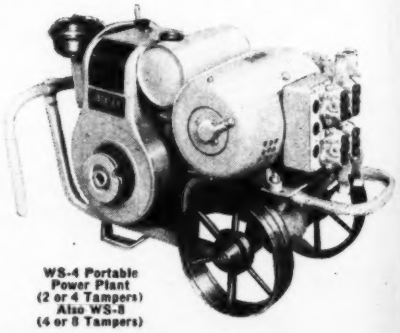
A Lightweight with a Heavyweight's Punch

Jackson PORTABLE POWER PLANTS

Here's a lightweight power plant that packs a lot of horsepower . . . sturdy, compact, portable, dependable, furnishing power anytime, anywhere. Conservatively rated at 2 KVA and 5 KVA (2000 and 5000 watts).

JACKSON Portable Power Plants are ***right*** for railroad use. For a quarter of a century they have been operating JACKSON ***vibratory*** Tie Tampers in 2, 4 and 8 combinations, putting up track uniformly, quickly and at lowest cost. These power plants are perfectly adapted to B & B service for operating a battery of floodlights or generating current for numerous B & B tools and equipment.

Ask for full details about the WS-4 and WS-8 JACKSON Portable Power Plants.



WS-4 Portable Power Plant (2 or 4 Tampers) Also WS-8 (4 or 8 Tampers)

ELECTRIC TAMPER & EQUIPMENT CO., Ludington, Michigan

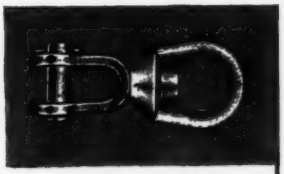
A prominent aviation manufacturer used the Laughlin Safety Hook shown, as part of a riveting machine set-up purposely devised for the safety and efficiency of women war workers.

This hook's unique, stout-springed safety latch holds its burden securely despite strain or jolts. It makes a hit with workers because it's safer.

This latch is available on all sizes and styles of Laughlin hoist hooks.

LAUGHLIN THIMBLES

Two styles . . . regular and plow steel pattern (extra heavy for use with plow steel and high tensile wire ropes).



LAUGHLIN SWIVELS

Made in the following types: jaw and jaw, chain swivel, swivel with jaw end, swivel with swivel. Drop-forged.

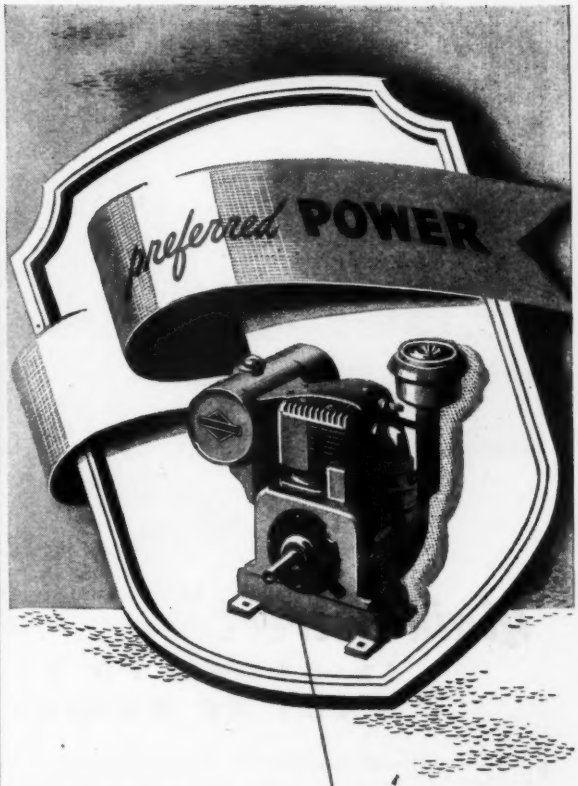
Write for catalog showing the complete line of Laughlin Wire Rope Fittings

Distributed through Mill Supply Houses

Look for Laughlin Products in
THOMAS' REGISTER and McRAE'S

FORGING A SHARE IN VICTORY

THE THOMAS LAUGHLIN *Company*
PORTLAND 6, MAINE



That's the "rating" for Briggs & Stratton 4-cycle, air-cooled gasoline engines — leaders in the field . . . Preferred power — based on the performance record of over 2,000,000 of these engines with their watch-like precision . . . the result of twenty-five years of continuous production, plus constant research and refinement.

Air-Cooled Power — 4 CYCLE BRIGGS & STRATTON GASOLINE ENGINES

Preferred power, by manufacturers, by distributors and dealers, by owners and users . . . because of *trouble-free performance,* easy starting, and economy of operation . . . Because of year after year of dependable service with minimum care or attention. We are now ready to help you plan for peacetime production of gasoline powered equipment, tools and appliances.
BRIGGS & STRATTON CORP., Milwaukee 1, Wis., U.S.A.

"Main Street"
IS GOING TO SEE A LOT OF CHANGES

Every City Official, Engineer and Plant and Factory superintendent had better be ready and willing to go along in a lot of new changes for the active days of postwar. Your America is going to be a pretty alive and progressive country. Things are going to happen very rapidly.

There is one mighty big and important fact that all should remember: . . . all progress, growth and development will absolutely depend upon an adequate and thoroughly dependable supply of water.

As after World War I, Layne is now swinging over to industrial and municipal Well Water System installation work. The requirements for peace time need are now being given special attention. The building of Layne high efficiency pumps is continuing without let up. Field testing and drill crews are up to full strength. Ready now are all kinds of parts, supplies and new equipment for the enlarging or the reconditioning of old wells. All branches of Layne service are ready to serve on important Water Supply work.

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WELL WATER SYSTEMS
DEEP WELL PUMPS

BUILDERS OF WELL WATER SYSTEMS FOR EVERY INDUSTRIAL AND MUNICIPAL NEED

HOW TO "Put a "Slow Order" on Curve-Rail Wear

Each Meco Lubricator Protects a Number of Curves

MECO-GREASE
Your Curves NOW!

✓ Save Materials

- Increase life of curve rails 2 to 4 times.
- Increase life of switch and curve rails in yards.
- Increase life of ties otherwise spike-killed in curves.
- Increase life of wheel flanges.

✓ Reduce Manpower Requirements

Realize savings in man hours

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- for renewing spike-killed ties.
- for realigning and regauging curves.
- for replacing wheels with sharp flanges.

✓ Speed Train Movements

Experience with 7000 Mecos on over 130 American Railroads has proven that MECOLUBRICATION

- permits faster speeds with safety.
- increases tonnage ratings up to 10%.
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- minimizes derailment hazards.

Maintenance Equipment Company
RAILWAY EXCHANGE BUILDING · CHICAGO, ILLINOIS

This Isn't Necessary

Does The Work of an Army of Men!

When a

JORDAN

Snow Plow is on the Job

To keep tracks clear and free from snow and ice in a speedy, economical manner, JORDAN is the machine to use.

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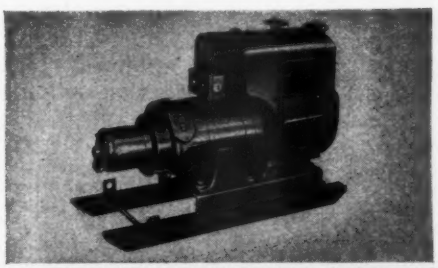
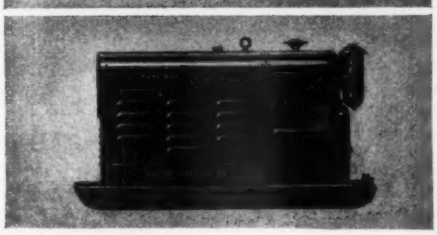
Walter J. Riley, *President*

Of special interest to

RAILROAD MAINTENANCE SUPERVISORS AND PURCHASING AGENTS

Complete specifications, details of construction, and full illustrations of Master Gas Electric Plants to meet any railroad electric power or lighting need in maintenance of ways, camps, construction projects, etc., is provided in a 40 page engineering manual published by the Master Vibrator Company. You may obtain a copy of this informative book, without charge or obligation, simply by writing Department of Information, Master Vibrator Company, Dayton 1, Ohio.





Eleven basic sizes from 500 watts to 17,000 watts and 30 different types to meet all AC or DC power or lighting requirements. Housed or open models . . . available with wheelbarrow, buggy or trailer mounting. For operating a single tool or motor, or floodlight . . . or gangs of tools, groups of motors, or lighting entire areas. Easy to put in operation . . . economical to operate and maintain. Compact, portable, self-contained.

For complete details write for Bulletin 594.

MASTER GAS-ELECTRIC GENERATING PLANTS

COMPACT PORTABLE

SAVE TIME AND SPEED WORK WHEREVER POWER OR LIGHTING IS REQUIRED

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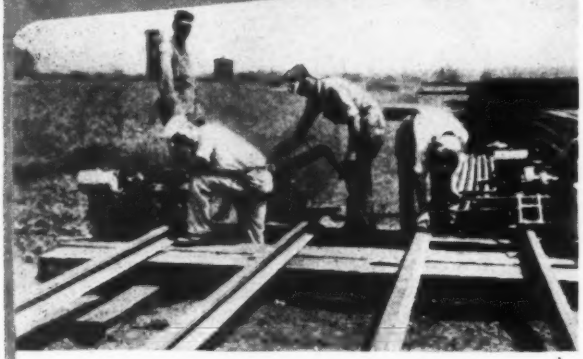
Dayton 1, Ohio • Distributors throughout United States and Canada

Products Include: Concrete Vibrators, Gas or Electric Surfacing Attachments, High Speed Tools • Vibratory Concrete Finishing Screeds • Rotary Concrete Floor Finishing Machines • Portable Gas Electric Generator Plants, 500 Watt to 17000 Watt, Voltage Regulators and Portable Mountings Optional • Master Flood and Shovel Light • Electronic Gas Engine Driven Power Plant Hammers

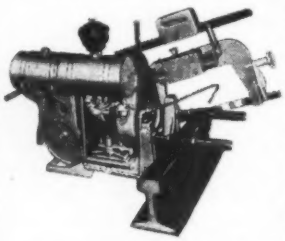
High Efficiency - Low Cost

RAIL CUTTING



with **RACINE** *High Speed*

PORTABLE RAIL SAWS



Here is a saw that saves valuable man hours and material. It does a smooth, clean rail cutting job.

It is compact, light in weight so that it can easily be transported for "on the track," yard or shop work. The use of Racine Rail Cutters eliminates possible damage to grain structure caused by torch cutting and the old "nick and break" method of rail cropping.

These saws are also ideal for proper cutting and fitting of rail at interlocking plants, crossings, curves and switches. They are available with gasoline, electric or compressed air motors. For full particulars write for Bulletin 58A. Address Dept. RE-S.

Advantageous TIME AND LABOR SAVING FEATURES

- ***Two men can easily carry a Racine Rail Cutter.***
- ***Cut can be made to within 3/10" from rail end.***
- ***Low blade and low operating cost.***
- ***When clamped to rail and started, saw needs no further attention until cut is completed.***
- ***Saves man hours, tool cost, time per cut and transportation of rails.***

STANDARD RACINE METAL CUTTING MACHINE

See the complete line of Racine Shop Saws for general or high speed production cutting of all metals. Capacities 6" x 6" to 20" x 20". Ask for Catalog No. 12.

The Production Saws of Modern Industry

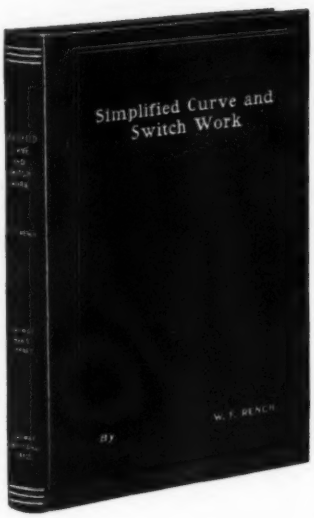
RACINE

TOOL AND MACHINE COMPANY

Standard for Quality and Precision

Racine, Wisconsin • U. S. A.

Simplified Curve and Switch Work



By

W. F. RENCH

Formerly Supervisor, Pennsylvania Railroad

This little book has practically revolutionized curve and switch calculation practice since its appearance 25 years ago. The proved accuracy of its methods has caused them to be adopted as standard practice on many roads.

Complex algebraic and geometric calculations are reduced to their simplest form and as nearly as possible to terms of simple arithmetic. The application of these calculations to the actual job is made plain by brief explanations.

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Curves: The Relining of Curves with a String—Preliminary Study of the Curve—The Solution of String Lining Problems—Super-elevation of Curves—The Spiral—The Vertical Curve—Economics of Curves—Practical Switch Connections: Essential Elements in the Design of Switch Connections—Rules for Computing Switch Dimensions—Rules for Various Functions of Turnouts—Practical Considerations in Installing Turnouts—Methods in Installing and Maintaining Switches—Siding Location: Simplified Field Work—Special Practices.

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RE&M 11-44

RICHARD J. SHANAHAN

Introducing!

U. S. Engine & Pump Company is pleased to announce the appointment of Richard J. Shanahan as Field Sales Manager. Mr. Shanahan is no stranger to the railroad field having been associated with it personally for the past 16 years, and previous to that having traveled with his father, a railroad supplier. He will be pleased to hear from his old friends, and will be glad to serve both old and new acquaintances.

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Halladay Tank Fixtures	Mansfield Water Columns	Halladay Outlet Valves
Float Valves	Switch Stands	Curtis Pumps
Pump Jacks	Wood Water Tanks	Semaphores
General Water Supplies	Water Handling Appliances	Tank Stuffing Boxes

U. S. ENGINE & PUMP COMPANY

DIVISION OF BATAVIA METAL PRODUCTS, INC.

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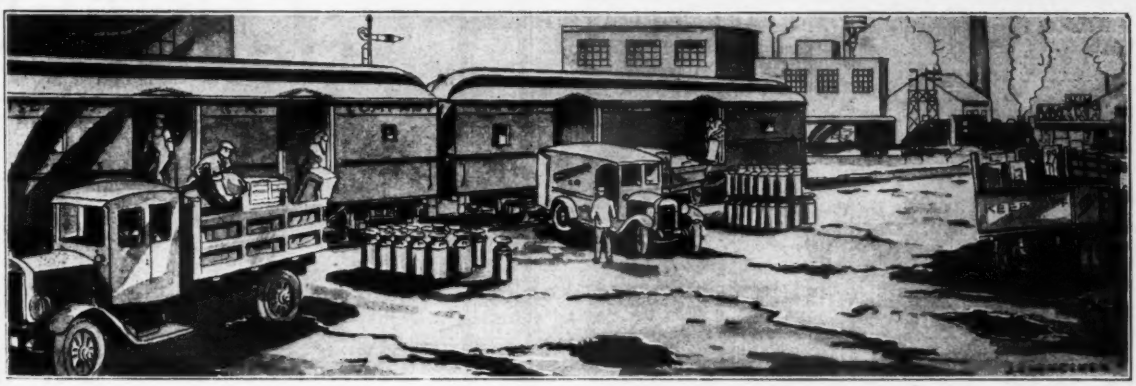

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● If your driveways, ramps, freight and passenger platforms are worn and rutted. If your warehouse and storage floors are chipped and cracked . . . wherever there is heavy trucking and traffic . . .

STONHARD RESURFACER

gives you quick and economical relief for both concrete and wood floors.

● If your tunnels, retaining walls, bridge supports, scale pits and other masonry surfaces which must withstand changing climatic conditions are spalled and broken . . .

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provides that extra density necessary to protect concrete surfaces from the penetration of moisture.

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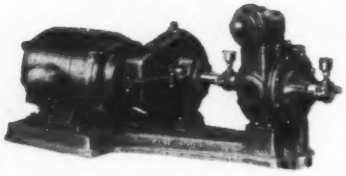
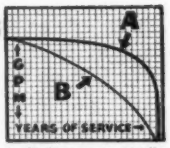
the PUMP that is "Self-Adjusting for Wear"





A—Blackmer pump capacity. Note the long sustained efficiency. B—Conventional Rotary Pump capacity.

Wear is confined to the tips of the buckets, which automatically compensate for wear.

This much can wear away, without affecting the capacity of the pump.

When worn out, replace the buckets and the pump is restored to normal efficiency.

for handling

DIESEL FUEL and FUEL OILS

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have been standard equipment for more than forty years.

POWER PUMPS

1 to 750 GPM. Pressures to 300 psi. Single or multiple units. All standard drives.

HAND PUMPS

1½ to 25 GPM—54 Models. Write for Bulletin 304— FACTS ABOUT ROTARY PUMPS

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BLACKMER ROTARIES
POWER PUMPS · HAND PUMPS

TRACTOR CRANES

built by MATHER

Your big jobs...quickly, efficiently done

Here is a MATHER Tractor Crane, small, compact, maneuverable — that thrives on a 24-hour working day . . . will do your big jobs quickly, economically and efficiently.

The Mather STEVEDORING CRANE:

Capacity 3 and 5 tons. Gas or Diesel powered tractor unit, load carried on driving wheels; solid or pneumatic tires; all welded frame; boom 16' standard (longer booms available); tip spool or sheaves optional.

All Mather Cranes are manufactured under patents issued and pending in the United States and foreign countries.

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and more representing the value, strength and extra quality of the Lufkin "Wolverine" Chrome Clad Steel Tapes. Jet black markings are easy to read in any light. Satin chrome finish won't rust, crack, chip or peel. One-piece winding handle gives good leverage and, when turned over, locks the tape at any desired point. See your dealer and write for catalog.

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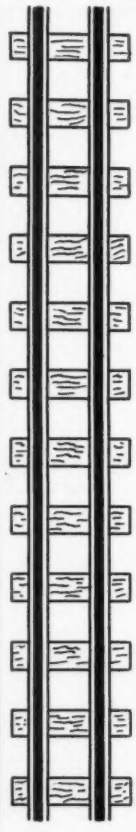

... PERFECT ALIGNMENT

FASTER, EASIER, BETTER

with the

BLOXHAM Track Liner

One way to ease the manpower problem is to provide more efficient tools.

With the BLOXHAM, your section crews can get *perfect alignment* in a shorter time and with less effort, because—

No stooping, no lifting, no "heeling up" . . . a straight pull on the rail *does it*.

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Available-at once

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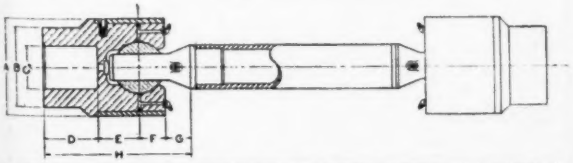
HEAVY-DUTY UNIVERSAL JOINTS TRANSMIT POWER THROUGH AN ANGLE

A new slipper type, lightweight universal spindle for high torque loads at high or low speeds. (1) *Sturdy* construction (2) *Simplified* design (3) *Smooth* operation (4) *Low* maintenance (5) *Full* lubrication (6) *Quality* materials (7) *Quick* delivery . . . Our engineers will be glad to recommend the proper size for your needs . . . write or phone immediately.



SERIES	A	B	C	D	E	F	G	H	MINIMUM LENGTH	CAPACITY HP PER 100 R.P.M.	PRICE IN F. O. B. LENGTHS*
MH 2	8	7	4	4½	3½	2	2½	12½	2-10½	75	$800
MH 3	9	8	4½	5½	4½	2½	2½	14½	3-3	100	$980
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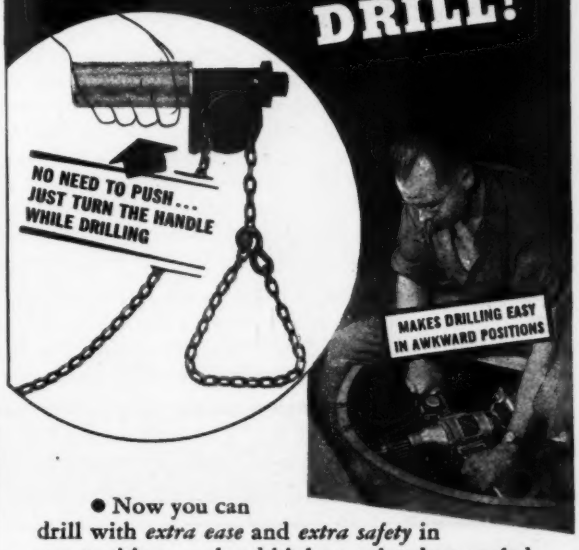
* Prices F. O. B. our works — Flanged ends furnished on request

MACKINTOSH-HEMPHILL CO.

Pittsburgh and Midland, Pa.

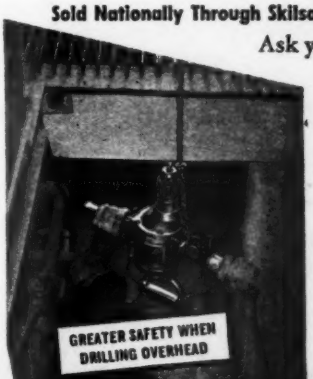
MAKE ANY DRILLING JOB in any position EASIER with this *Pressure Handle* on a SKILSAW DRILL!



● Now you can drill with *extra ease* and *extra safety* in any position . . . head-high, overhead or on ladders . . . by simply attaching this Pressure Handle to your SKILSAW DRILL *or any make of drill.* Pressure Handle gives the operator complete control of drilling pressure at all times . . . eliminates twist drill breakage . . . saves the time of an extra man with ropes or chains to hold the drill.

Fits SKILSAW DRILL Models "64", "80", "82", "83", "101", "103", "121", "123", "141", "143", and all other makes of electric or pneumatic drills of from ⅜ in. to 1 in. capacity in steel.

Sold Nationally Through Skilsaw Distributors for $30



Ask your distributor today for a demonstration of this Pressure Handle in your locomotive and car shops and in your power tool cars.

SKILSAW, INC.
5033-43 Elston Ave.
Chicago 30, Ill.

Sales and Service Branches in All Principal Cities

SKILSAW PORTABLE ELECTRIC TOOLS
MAKE AMERICA'S HANDS MORE PRODUCTIVE

BALANCED FLYWHEEL-FAN

another "PLUS FEATURE" IN ALL WISCONSIN Air-Cooled ENGINES

Every Wisconsin Air-Cooled Engine is equipped with a high-efficiency fan that is cast integrally with the flywheel. And each of these flywheel-fans is carefully balanced on a combination balancing and boring machine which accurately locates the heavy spots by means of gravity pendulum swing . . . and then takes out the excess metal, as required. Each unit is tested for smooth, free-running balance.

Just another production detail that removes a potential source of vibration and needless wear . . . *right at the source!* Isn't that the kind of an engine you want on your equipment?

Most H.P. per pound

WISCONSIN MOTOR Corporation

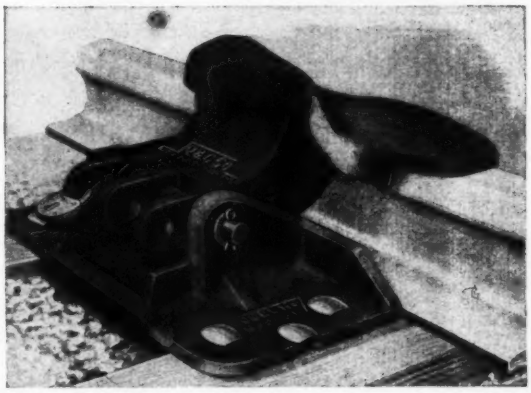
MILWAUKEE 14, WISCONSIN, U. S. A.

World's Largest Builders of Heavy-Duty Air-Cooled Engines

KEEP TRACKS CLEAR

By Using

Q & C DERAILS



Install Q&C Derails at clearance points to help guard against interruptions in service on your principal tracks. Made in Hand Throw, Sliding and Portable Types, all adjustable for various sizes of rail, hence no adzing or shimming of ties is necessary and inventories are reduced.

Specify Q&C Derails for Safety, Economy and Durability

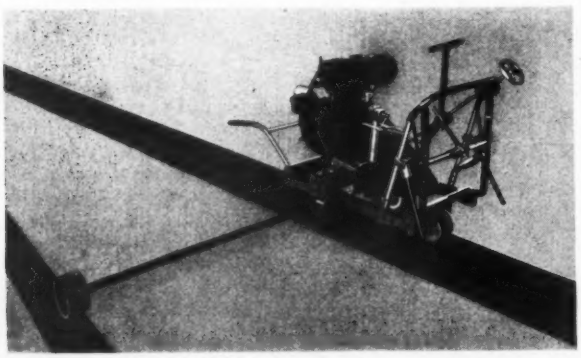
THE Q AND C COMPANY

Chicago New York St. Louis

FOR SPEEDY GRINDING OF STOCK RAILS AND SWITCH POINTS

Remove overflowed metal quickly and accurately from stock rails and switch points with this RTW Portable Stock Rail Grinder, Model P-16. Reshapes angle of switch points, performs slotting and grooving operations in longitudinal rail heads for copper strip insertion, serves as a power plant for operating auxiliary grinding and drilling attachments. Specially bonded wheels provide maximum cutting efficiency. Easily derailed for clearing tracks.

The steady, flexible operation of the P-16 Model has given it a reputation for excellence. Write for latest data bulletin.



Railway Trackwork Co.

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5489

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of Railway Engineering and Maintenance published monthly at Chicago, Ill., for October 1, 1944.

State of Illinois } ss.
County of Cook }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Neal D. Howard, who, having been duly sworn according to law, deposes and says that he is the Editor of the Railway Engineering and Maintenance and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Simmons-Boardman Publishing Corp., 105 W. Adams St., Chicago 3, Ill. Editor, Neal D. Howard, 105 W. Adams St., Chicago 3, Ill. Managing Editor, Merwin H. Dick, 105 W. Adams St., Chicago 3, Ill. Business Manager, S. Wayne Hickey, 105 W. Adams St., Chicago 3, Ill.

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NEAL D. HOWARD, Editor.

Sworn to and subscribed before me this 30th day of September, 1944.
[Seal.]

ANNE A. BOYD, Notary Public.

(My commission expires Dec. 10, 1944.)

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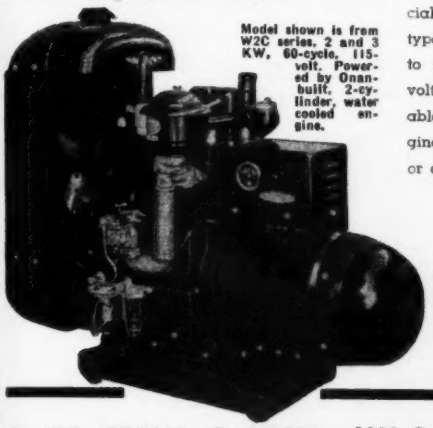

Model shown is from W2C series. 2 and 3 KW, 60-cycle, 115-volt. Powered by Onan-built, 2-cylinder, water cooled engine.

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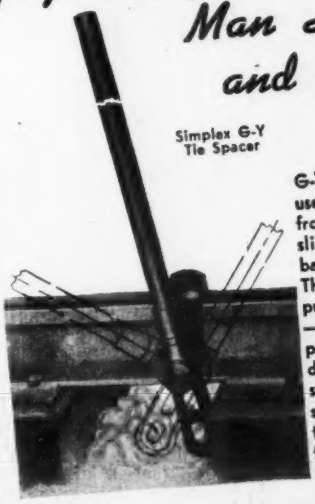
G-Y Tie Spacers Save Man Hours and Ties



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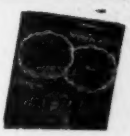

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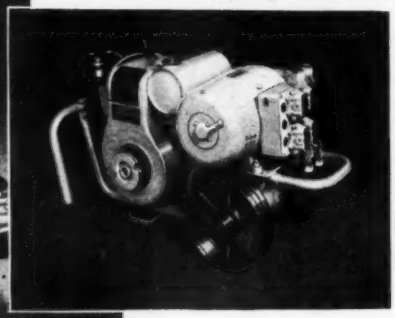

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ALPHABETICAL INDEX TO ADVERTISERS

Air Reduction Sales Co. 1005
American Brake Shoe Co. 981
American Hoist & Derrick Co. 976
American Locker Company, Inc. 982
American Lumber & Treating Company 980
Andover Motors Corporation 106
Barco Manufacturing Company 983
Blackmer Pump Company 1074
Briggs & Stratton Corp. 1069
Buda Co., The 1063
Buffelen Lumber & Mfg. Co. 1002
Chicago Steel Foundry Co. 1074
Chipman Chemical Company 988
Cullen-Friestedt Co. 1067
Dearborn Chemical Co. 975
Eastern Shore Fabricators, Inc. 1068
Eaton Manufacturing Company 974
Electric Tamper & Equipment Co. 1068-1078
Fairbanks-Morse & Co. 993
Fairmont Railway Motors, Inc. 978-979
Flexrock Company 1077
Flintkote 1007
Harnischfeger Corporation 997
Hi-Way Service Corporation 999
Holyoke Compressor and Air Tool Dept. 1080
Independent Pneumatic Tool Co. 994-995
Industrial Brownhoist 1066
Johns-Manville 1000
Jordan Co., O. F. 1071
Koehring Company 998
Laughlin Co., The Thomas 1069
Layne & Bowler, Inc. 1070
LeTourneau, Inc., R. G. 987
Link-Belt Speeder Corporation 992
Lufkin Rule Co., The 1074
Mackintosh-Hemphill Co. 1075
Maintenance Equipment Company 1070
Mall Tool Company 1067
Master Builders Company, The 990-991
Master Vibrator Company 1071
Mather Manufacturing Company, Inc. 1074
National Lock Washer Company, The 973
Nordberg Mfg. Co. 1003
Northwest Engineering Co. 1004
Oliver Iron & Steel Corporation 986
Onan & Sons, D. W. 1077
Ownership Statement 1076
Oxweld Railroad Service Company, The 1010
Pittsburgh Pipe Cleaner Company 984
Presstite Engineering Company 1001
Q and C Co., The 1076
Racine Tool & Machine Co. 1072
Railway Maintenance Corp. 996
Railway Track-work Co. 1076
Ramapo Ajax Division 981
Reliance Spring Washer Division 974
Schramm, Inc. 1065
Simmons-Boardman Publ. Corp. 1072
Skilsaw, Inc. 1075
Stonhard Company 1073
Templeton, Kenly & Co. 1077
Timber Engineering Company, Inc. 989
Timken Roller Bearing Company, The 1079
U. C. Lite Mfg. Co. 1077
Union Carbide and Carbon Corporation 1010
Union Metal Manufacturing Co., The 1012
U. S. Engine & Pump Company 1073
Warren Tool Corporation 977
Washington Veneer Co. 1002
Wisconsin Motor Corporation 1076
Woodings Forge & Tool Co. 1009
Woodings-Verona Tool Works 1009
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FC4-28

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**Blue Brute Compressors and Air Tools painted olive drab for the Army, battlesh gray for the Navy.

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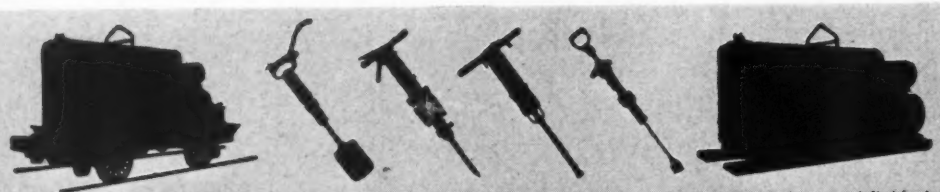

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